

Analysis of the Gas Companies' June 15, 2021, Natural Gas Leak and Emission Reports

JOINT STAFF REPORT

CALIFORNIA PUBLIC UTILITIES COMMISSION
CALIFORNIA AIR RESOURCES BOARD

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SB 1371 (Leno) Natural Gas: Leakage Abatement | *R.15-01-008, D.17-06-015, D.19-08-020*



**California Public
Utilities Commission**

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Executive Summary

This is the seventh annual report (2021 Joint Report) compiled jointly by the California Public Utilities Commission (CPUC) and the California Air Resources Board (CARB) in compliance with Senate Bill (SB) 1371 (Leno, 2014) on natural gas emissions, as ordered by the CPUC decision approving the Natural Gas Leak Abatement Program (Program) (D.17-06-015).

The 2021 Joint Report compiles and analyzes the 2020 natural gas emissions estimates from sources of fugitive leaks and vented emissions in the natural gas transmission and distribution system in California, as reported by California natural gas utilities and independent storage providers (ISPs) (collectively “gas companies” or “respondents”).¹ This report also presents and discusses natural gas emissions estimates by system category, source classification, and company.²

Respondents filed their 2020 natural gas emissions estimates and related information by June 15, 2021, pursuant to the data request issued by CPUC Staff on March 31, 2021. The data request included reporting templates and associated guidelines to gas companies.

Staff used the report filings, including gas company responses to Staff follow-up questions and comments related to the initial report filings, to prepare the 2021 Joint Report. Staff also adjusted the 2019 natural gas emissions estimates reported in the 2020 Joint Report to correct misstatements identified by respondents for this report.

Gas companies are in the process of developing improved methods to estimate emissions for several system categories. Before new methods can be incorporated into the Program, gas companies must receive CPUC approval. Although CPUC has approved several new estimation methods for use in estimating 2019 and 2020 emissions, CPUC has not yet approved adjustments to the 2015 Baseline emissions estimates based on improved methods to estimate emissions. Inconsistencies between methods used for the 2015 baseline estimates and future years prohibit direct comparison of estimated emissions to the baseline for some system categories. Staff will continue to work with the gas companies to consider adjustments to the 2015 Baseline emissions in future Joint Reports to account for methodological changes and other information that affects the 2015 Baseline emissions.

The information in this report should be used by stakeholders to help determine general emission trends over time and identify where potential emission reductions can be achieved to meet the State’s overall goal of reducing natural gas emissions 40% from 2015 Baseline levels by 2030,³ while maintaining the safe,

¹ For the purposes of this report, “emissions” include both fugitive leaks and vented emissions of natural gas, unless otherwise noted.

² The term “system category” is used to describe the grouping of natural gas emissions based on where the emissions occur in the natural gas transmission and distribution system. The Joint Report groups emissions into seven distinct system categories (see Table 2 for the list of system categories). The term “source classification” refers to the grouping of natural gas emissions by emission type, including the manner in which the emission occurs or the method by which emissions are estimated (see Table 3 for the list of source classifications).

³ This goal was established by SB 1383 (Lara, 2016).

reliable, and affordable operation of the regulated natural gas storage and delivery systems, as stated in SB 1371.

Key Findings

The total statewide estimated natural gas emissions from sources of fugitive leaks and vented emissions in the transmission and distribution system for the 2020 calendar year are 5,674 million standard cubic feet (MMscf), which are 1% lower (36 MMscf) than the 2019 adjusted emissions estimates, and 14% below (927 MMscf) the 2015 Baseline emissions estimates (see Table 1).⁴ Staff note that the estimated year-over-year (YOY) natural gas emissions reduction from 2019 to 2020 and the overall natural gas emissions reduction relative to the 2015 Baseline emissions may not be reflective of the actual reductions associated with implemented best practices (BP) due to the limitations of using population-based emissions estimates, as described in more detail below.

While there were natural gas emissions decreases observed in five of the seven reported system categories from 2019 to 2020, most of the overall YOY decrease is the result of emission reductions reported in Distribution Mains and Services (DM&S) (65 MMscf decrease), Transmission Pipelines (33 MMscf decrease), and Transmission Metering and Regulating (M&R) Stations (30 MMscf decrease) system categories (see Table 2). A detailed analysis of natural gas emissions estimates from individual system categories is provided later in this report.

Some gas companies are developing leaker-based methodologies to replace population-based methodologies for estimation of natural gas emissions from Distribution M&R Stations and Customer Meters system categories. Population-based estimates are calculated based on the number of units within a category multiplied by an emission factor (EF). Therefore, population-based emissions estimates stay constant from year to year unless a change is made to the number of units or to the EFs. Leaker-based emissions estimates, on the other hand, are calculated by using measured leaks from surveys to estimate emissions. Staff requested that gas companies that are developing leaker-based methodologies for Distribution M&R Stations and Customer Meters report natural gas emissions for these system categories using both leaker-based and population-based methodologies for 2019 and 2020. Staff note that within the tables, figures, and text in the main body of this report, total natural gas emissions in 2019 and 2020 were estimated using population-based reporting for Distribution M&R Stations and Customer Meters. This ensures consistency with the methods used to estimate the 2015 Baseline emissions, which also used population-based reporting.

As noted in Table 1 and throughout this report, Staff anticipate potential adjustments to the 2015 Baseline emissions to incorporate corrections and additional information and data and to account for the transition from using population-based to leaker-based methods for estimating natural gas emissions from Distribution M&R Stations and Customer Meters. Staff anticipate that the use of leaker-based methodologies will provide more accurate estimates of natural gas emissions for Distribution M&R and

⁴ Methane is the primary component comprising approximately 93.4% of the volume of utility grade natural gas.

Customer Meter system categories. Using leaker-based methodologies will also allow gas companies to measure progress resulting from deploying BPs.

If a leaker-based approach is approved and adopted for the 2015 Baseline emissions, then it is likely that 2019 and 2020 data that also are based on a leaker-based approach would be used in future Joint Reports. For this 2021 Joint Report, leaker-based data submitted by some gas companies is presented in Appendix A. Staff look forward to further discussion with gas companies regarding the use of leaker-based emissions estimates and potential adjustments to the 2015 Baseline emissions estimates during the 2022 Winter Workshop.

The total statewide 2020 reported natural gas emissions of 5,674 MMscf equate to 2.54 million metric tonnes of carbon dioxide equivalents (MMT CO₂e) using the Intergovernmental Panel on Climate Change (IPCC) Forth Assessment Report (AR4) 100-year methane Global Warming Potential (GWP) of 25. The total 2020 reported natural gas emissions equate to 7.32 MMT CO₂e using the 20-year methane GWP of 72.

Table 1: Total SB 1371 Sector Natural Gas Emissions							
Sector Emissions	2015 Baseline	2019 ^b	2020	2015 Baseline to 2020 Change ^c		2019 - 2020 YOY Change	
				MMscf, MMT CO ₂ e	% Change	MMscf, MMT CO ₂ e	% Change
Volume of Natural Gas (MMscf)	6,601 ^a	5,710	5,674	(927)	(14%)	(36)	(1%)
Mass Equivalent, 100-Yr GWP, AR 4 (MMT CO ₂ e)	2.96 ^a	2.56	2.54	(0.42)	(14%)	(0.02)	(1%)
Mass Equivalent, 20-Yr GWP, AR 4 (MMT CO ₂ e)	8.51 ^a	7.36	7.32	(1.20)	(14%)	(0.05)	(1%)

^a Subject to revision as improved methodologies are approved and adopted.

^b Estimated emissions changes are uncertain because the program is in flux and therefore the emissions changes do not reflect the status of implementation of best practices.

^c The 2019 total has been modified from the 2020 Joint Report, which is described in the section, "2019 Data Adjustments and Corrections" of this Joint Report.

Subsequent sections of this report analyze the total natural gas emissions for 2020 by examining individual system categories and source classifications. Table 2 shows total estimated natural gas emissions and emissions trends grouped by system category, and Table 3 shows total estimated natural gas emissions and emissions trends grouped by source classification.

In large part, this Joint Report will focus on the YOY changes from 2019 to 2020. The current focus on YOY changes rather than comparisons to the 2015 Baseline emissions is due to the use of different emissions estimation methodologies in different years.

Baseline Adjustments

Since the origination of the Program and publishing of the first Joint Report, Staff and gas companies have developed improved methodologies and refined data and information used to estimate natural gas emissions. However, the 2015 Baseline emissions have not been adjusted since they were published in the first Joint Report. 2015 Baseline emissions estimates for several system categories are based on outdated emission factors and outdated or incomplete data or information that may have resulted in overstated or understated 2015 Baseline emissions estimates.

CPUC anticipates adjusting the 2015 Baseline emissions to incorporate additional data and information and revised emissions estimation methodologies that improve the accuracy of the emissions estimates. Comparisons of annual emissions included in this Joint Report to the unadjusted 2015 Baseline emissions are uncertain and may lead to misleading conclusions regarding the effectiveness of implemented BPs and potential opportunities for cost-effective emissions reductions due to differences in the types of data and information and emissions estimation methodologies used. Staff are evaluating potential adjustments to the 2015 Baseline emissions estimates with the aim to make all the known adjustments simultaneously to minimize changes to the 2015 Baseline emissions on an ongoing basis. Additional information regarding specific adjustments to the 2015 Baseline emissions will be provided in future Joint Reports or other documents following Staff evaluation and CPUC approval of proposed adjustments.

Natural Gas Emissions by System Category

As indicated in Table 2, there was a 1% reduction in the total 2019 to 2020 YOY natural gas emissions. Table 2 also shows that there were larger changes in 2019 to 2020 YOY natural gas emissions for individual system categories. Staff note that there were three different kinds of emissions changes observed from 2019 to 2020:

- Reductions resulting from modifications to or replacement or retirement of equipment. These reductions are often described as verifiable reductions because they can be substantiated or verified in the field.
- Reductions resulting from methodological changes in estimating emissions. These reductions are often described as improvements in the current reporting year but can make it challenging to compare current-year emission totals with from those from previous years that use different methods to estimate emissions. Significant changes of this type are shown in Appendix A.
- Reductions or increases due to moving emissions to different categories within the reporting structure. These changes demonstrate that the reporting template is a living document that can be improved, but these changes may also make it challenging to compare the current year's emissions with those from previous years.

Table 2: Total Natural Gas Emissions by System Category⁵										
System Category	2015 Baseline		2019		2020		2015 Baseline to 2020 Change		2019 - 2020 YOY Change	
	MMscf	% Total	MMscf	% Total	MMscf	% Total	MMscf	% Change	MMscf	% Change
Transmission Pipeline	549	8%	294	5%	261	5%	(288)	(52%)	(33)	(11%)
Transmission M&R Station	1,007	15%	790	14%	760	13%	(247)	(25%)	(30)	(4%)
Compressor Station	163	2%	144	3%	143	3%	(20)	(12%)	(1)	(1%)
Distribution Mains & Services	1,703	26%	1,243	22%	1,178	21%	(525)	(31%)	(65)	(5%)
Distribution M&R Stations	1,348	20%	1,385	24%	1,482	26%	134	10%	97	7%
Customer Meter	1,638	25%	1,693	30%	1,704	30%	66	4%	11	1%
Underground Storage	193	3%	161	3%	146	3%	(47)	(24%)	(15)	(9%)
Total	6,601	100%	5,710	100%	5,674	100%	(927)	(14%)	(36)	(1%)

The first system category, Transmission Pipelines, continued to account for about 5% of the total 2020 emissions but showed an 11% YOY decrease of 33 MMscf from 2019.

Transmission Metering & Regulation (M&R) Stations' 13% proportional share of the total 2020 emissions remained similar to the 14% share from 2019 emissions. The YOY emissions decreased 30 MMscf or 4% from the total of 790 MMscf in 2019 to 760 MMscf in 2020. Most of the YOY change was due a reporting template change moving farm taps from being accounted for within Transmission M&R Stations emissions to Distribution M&R Stations.

The share of the 2020 total emissions from Compressor Stations remained constant at 3%. The 2020 Compressor Station emissions decreased by 1 MMscf YOY from 2019.

Distribution Mains & Services (DM&S) pipeline emissions decreased by 65 MMscf from 1,243 MMscf in 2019 to 1,178 MMscf in 2020.

Distribution M&R Stations emissions increased by 97 MMscf YOY from 1,385 MMscf in 2019 to 1,482 MMscf in 2020. The reporting of 2019 and 2020 emissions here and in the main body of the report uses the population-based approach, while the leaker-based approach is shown in Appendix A.

⁵ For more sub-category details see Table 7: Detailed Emissions by Category, Source, and Classification 2015-2019. In addition, in 2015 and 2016 the Aliso Canyon storage well leak was excluded from Unusual Large Leaks because it was accounted for by other state agencies.

Customer Meters emissions increased by 11 MMscf YOY from 1,693 MMscf in 2019 to 1,704 MMscf in 2020. This reporting of 2019 and 2020 emissions uses the population-based approach, while the leaker-based approach is shown in Appendix A.

Underground Storage emissions decreased 15 MMscf or 9% YOY from 161 MMscf in 2019 to 146 MMscf in 2020. Gas companies reported that compliance with the requirements in CARB’s Oil and Gas Methane Regulation (COGR) contributed to emissions reductions noted for this system category.

Lastly, no unusual large leaks were reported in 2020.

Natural Gas Emissions by Source Classification

Natural gas emissions can be grouped into the five main source classifications, including Population-Based Emissions, Graded Pipeline Leaks, Blowdowns, Vented Emissions, and Damages. An additional source classification, Other Leaks, is used for emission sources that do not fit one of the five main source classifications. Table 3 shows the YOY changes by source classification.⁶

Table 3: Total Natural Gas Emissions by Source Classification										
Source Classification	2015 Baseline		2019		2020		2015 Baseline to 2020 Change		2019 - 2020 YOY Change	
	MMscf	% Total	MMscf	% Total	MMscf	% Total	MMscf	% Change	MMscf	% Change
Population-Based Emissions	3,931	60%	3,782	66%	3,860	68%	(71)	(2%)	77	2%
Graded Pipeline Leaks	1,458	22%	1,110	19%	1,054	19%	(404)	(28%)	(56)	(5%)
Blowdown	603	9%	414	7%	360	6%	(244)	(40%)	(54)	(13%)
Vented	258	4%	220	4%	215	4%	(42)	(16%)	(5)	(2%)
Damages	318	5%	153	3%	159	3%	(159)	(50%)	6	4%
Other Leaks	33	0.5%	30	1%	26	0%	(7)	(22%)	(4)	(14%)
Total Sector Emissions	6,601	100%	5,710	100%	5,674	100%	(927)	(14%)	(36)	(1%)

⁶ See Table 7: Detailed Emissions (by Category, Source, and Classification) 2015, 2018-2019, in the body of the report.

YOY emission changes by source classification are summarized as follows, ordered by largest emissions to smallest:

- Consistent with prior years, the Population-Based Emissions classification makes up the single largest source classification of emissions at 68% of the 2020 total emissions.⁷ The four individual emission sources that are part of this category are provided in Table 4.
- Graded Pipeline Leaks remained relatively constant with 1,110 MMscf in 2019 and 1,054 MMscf in 2020. Overall, this category decreased YOY by 5% or 56 MMscf.
- Blowdowns decreased by 13% YOY from 414 MMscf in 2019 to 360 MMscf in 2020. This category has emissions that are cyclical and vary with annual operating conditions. For a more detailed analysis, see Table 8.
- Vented Emissions also remained relatively constant with 220 MMscf in 2019 and 215 MMscf in 2020. Overall, this category decreased YOY by 2% or 5 MMscf. For a more detailed analysis, see Table 9.
- Emissions from Damages have also remained relatively constant with the previous year, increasing by 4% YOY from 153 MMscf in 2019 to 159 MMscf in 2020.
- Other Leaks decreased from 30 MMscf in 2019 to 26 MMscf in 2020. Overall, this category decreased YOY by 14% or 4 MMscf.

⁷ The Population-Based Emissions is comprised of Transmission and Distribution M&R Stations (58%), Customer Meter Sub-Assemblies (42%), and Transmission Pipelines Leaks (>0.1%).

Introduction and Background

On September 14, 2014, Governor Jerry Brown signed into law SB 1371 (Leno, 2014) requiring reporting and mitigation of emissions from California Public Utilities Commission (CPUC)-regulated gas pipeline facilities.⁸ The bill requires gas corporations to file a report summarizing utility leak management practices, a list of new natural gas leaks by grade, a list of open leaks that are being monitored or are scheduled to be repaired, and a best estimate of gas loss due to leaks. In accordance with SB 1371, the CPUC and California Air Resources Board (CARB) prepared this annual report, which analyzes and accounts for natural gas from leaks and vented emissions from natural gas transmission, distribution, and storage in California.⁹

SB 1371 also requires the adoption of rules and procedures to minimize natural gas leakage from Commission-regulated natural gas pipeline facilities consistent with Section 192.703(c) of Subpart M of Title 49 of the Code of Federal Regulation, the Commission's General Order (GO) 112-F, and the State's goal of reducing GHG emissions.

In January 2015, the Commission opened an Order Instituting Rulemaking (R.) 15-01-008 to implement the provisions of SB 1371.

On June 15, 2017, the Commission in decision (D.)17-06-015 approved the Natural Gas Leak Abatement (NGLA) Program consistent with SB 1371.¹⁰ This decision established Best Practices (BPs) and reporting requirements for the NGLA Program to be developed by the CPUC in consultation with CARB. The decision implements the following to support the State's goal of reducing 2015 Baseline natural gas emissions 40% by 2030:

1. Annual reporting for tracking natural gas emissions;
2. Twenty-six mandatory BPs for minimizing natural gas emissions pertaining to policies and procedures, recordkeeping, training, experienced trained personnel, leak detection, leak repair, and leak prevention;
3. Biennial Compliance Plan (CP) incorporated into the respondents' annual Gas Safety Plans, beginning in March 2018; and
4. Cost recovery process to facilitate Commission review and approval of incremental expenditures to implement BPs, Pilot Programs and Research & Development.

In D.17-06-015, the Commission affirms that the 2015 Baseline emissions estimates will provide the starting point to measure future natural gas emissions reductions.¹¹

⁸ Leno, Chapter 525, Statutes of 2014.

⁹ Unless specified as a fugitive leak or vented emission, for the purposes of this report "emissions" include both fugitive leaks, and vented emissions of natural gas.

¹⁰ docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=190740714.

¹¹ *Ibid*, Findings of Fact #13, pg. 145.

To culminate the second phase of R.15-01-008, on August 15, 2019, the Commission approved D.19-08-020 establishing additional policies and mechanisms for the NGLA program pursuant to SB 1371 and SB 1383 (Lara, 2016).¹² This decision requires:¹³

- Utility Proposed Cost-Effectiveness Methodology and two Cost-Benefit Analyses for evaluating proposed methane reduction measures and the Biennial Methane Leaks Compliance Plans (Compliance Plans).
- Adopting a restriction on rate recovery beginning in 2025, for emissions greater than 20% below the 2015 Baseline levels for Pacific Gas and Electric Company (PG&E) and Southern California Gas Company (SoCalGas) to ensure they achieve their intended emissions reductions.¹⁴
- Two workshops to refine the scope and detail of the Compliance Plans and Tier 3 Advice Letters pertaining to cost-effectiveness and cost-benefit analysis and other elements as directed in D.17-06-015.
- Developing a process that gas companies can rely on, prior to submittal of the next Compliance Plans in March 2020, to adjust Emission Factors (EFs) used for annual reports to account for methane reduction measures in consultation with CARB.
- Extending the timeframe from 2020 to 2021 for the CPUC's Safety and Enforcement Division and Energy Division Staff to complete a written program evaluation of the NGLA program after Commission approval of the second set of Compliance Plans in late 2020. In June 2021, the due date for this program evaluation was further extended to December 2022.
- Commission direction of the NGLA program moving forward, following submission of the second set of Best Practices Biennial Compliance Plans due March 2020 and the NGLA program evaluation in 2021 (now due in 2022).

All directives of D.17-06-015 remain in effect unless they are superseded by directives and/or guidance provided by this decision. Lastly, in D.19-08-020 the Commission closed R.15-01-008.

In addition, SB 32 (Pavley, 2016), which sets a 40% GHG reduction target from 2013 levels by 2030, was passed and signed into law in 2016.¹⁵ SB 605 (Lara, 2014) directed CARB to develop plans to reduce statewide natural gas emissions, which it did in the Short-Lived Climate Pollutant Reduction Strategy.¹⁶

¹²docs.cpuc.ca.gov/PublishedDocs/Published/G000/M311/K449/311449621.PDF.

¹³*Ibid*, pg. 2.

¹⁴ D.20-05-038, Order Correcting Error in D.19-08-020, states at pg. 1 that: "For SoCalGas, any necessary reductions in rate recovery for methane emissions for 2025 and beyond as directed in this Decision should be identified in its Annual Regulatory Account Balance Update for rates effective January 1, 2027."

<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M335/K617/335617960.PDF>.

¹⁵ Pavley, Chapter 249, Statutes of 2016.

¹⁶ <https://ww2.arb.ca.gov/resources/documents/slcp-strategy-final>.

Purpose of the Annual Natural Gas Leak Abatement Report

The report estimates natural gas emissions from the storage and delivery systems in aggregate, by company, by system category, by source classification, and by grade. The information should be used to help determine where emission reductions can be achieved while maintaining the safe and reliable operation of commission-regulated natural gas pipelines and other facilities. The metrics used to compile this report provide operators, the Commission, and the public with information about the type, number, and severity of natural gas emissions and the leaked quantity of natural gas emitted to the atmosphere over time.

This report provides a summary of the 2020 emissions inventory reports submitted by the gas companies on June 15, 2021, and differs from prior year reports due to the following three issuances to the list serve.

With the issuance of the March 31, 2021, reporting templates:

- Gas companies were informed they may move the reporting of farm taps from Transmission M&R Stations to Distribution M&R Stations. This request was originally made at the 2021 Winter Workshop and through follow up comments from gas companies. However, when Staff reviewed the data submitted on June 15, 2021, it was not clear that the farm taps were specified in the reporting and that the input pressure was below 300 pounds per square inch (psi). Further changes to better designate farm taps may be reviewed at the 2022 Winter Workshop.
- Staff added columns to the Distribution Pipelines template to designate type of repair.
- Staff edited the Customer Meters template to require information on the repair type.
- Staff also provided a worksheet for “Meter Leak, Leak Count” in Customer Meters so that gas companies could report bubble-size indications per leak and consequent bubble size leaker-based emission factors. After the June 15, 2021, reporting, Staff noted that this was completed by only PG&E. Staff later requested PG&E to submit a population-based analysis so that the change in emissions from 2019 to 2020 due to the methodological change could be better understood. The tables and Figure 1 of the body of this report use population-based analysis for Customer Meters to ensure consistency with comparing to the 2015 baseline, while the leaker-based analysis is presented in Appendix A.

With the issuance of the April 15, 2021, update:

- Staff informed gas companies that for Distribution M&R Stations, they could submit emission estimates leaker-based emission factors from the table, “Table W-7 of Subpart W of Part 98 – Default Methane Emission Factors for Methane Distribution” that were converted to natural gas using the 0.934 methane conversion factor. The listing of emission factors was updated in the Emission Factors spreadsheet of the reporting template. Also, if respondents did not have leaker-based information, they were directed to still use the population-based approach with corresponding EFs. PG&E, SoCalGas, and SDG&E submitted emission estimates for Distribution M&R Stations using a leaker-based approach. Staff later requested that these gas companies also submit a population-based analysis so that the reduction in emissions observed in 2020 resulting from a change in methodology change could be better understood. The tables

and Figure 1 of the body of this report use population-based analysis for Distribution M&R Stations to ensure consistency with comparing to the 2015 baseline, while the leaker-based analysis is presented in Appendix A.

With the issuance of the May 7, 2021, update:

- Gas companies were informed they may submit their data and response to the Supplemental Questionnaire over email or through CPUC's secure file transfer protocol (FTP). This was a change from previous years which advised submitting a DVD.

In keeping with prior reports, in large part the data reported by gas companies in 2020 continued to require the use of 1996 GRI EFs.¹⁷ However, Staff continue to evaluate improvements to the EFs and consider the CARB studies of DM&S pipeline and Customer Meters leaks.

This report includes general discussions of changes to operational practices, new methods for leak and emission detection, and mitigation programs. Lastly, Staff tried to include information on any improvements in the data capture resulting from gas company efforts (e.g., verification of asset inventory, integrating system databases, etc.), changes to methodology for estimating emissions (e.g., calculating emissions for all blowdowns not just those above a specific threshold), and corrections to the classification of data or errors in the data that may provide greater accuracy in reporting.

Basis for the Annual Natural Gas Leak Abatement Report

On March 31, 2021, Staff issued a data request to CPUC jurisdictional natural gas utilities and independent storage providers (ISPs) in California to collect the information required by Article 3, Section 975 (c) and (e)(6), using templates jointly developed by CPUC and CARB Staff (See Appendix C for detailed wording).

The data were tabulated into the following seven systems categories (which included subgroupings by type):

1. Transmission Pipelines (leaks, damages, blowdowns, components, and odorizers);
2. Transmission Metering and Regulation (M&R) stations (station leaks and emissions, and blowdowns);
3. Compressor stations (compressor leaks and emissions, blowdowns, components leak and emissions, and storage tanks);
4. Distribution Pipeline Mains and Services (DM&S) (leaks, damages, and blowdowns),
5. Distribution M&R stations (station leaks and emissions, and blowdowns),
6. Customer Meters (leaks, and venting); and
7. Underground Storage Facilities (leaks, compressors leaks and emissions, blowdowns, and component leaks and emissions).

¹⁷ Appendix 9 of the reporting template lists the EFs by system category.

The respondents provided contextual information and explanations for their data to help Staff understand the composition of the emissions, emission sources, and related calculations underlying the emission estimates. The respondents summarized the data and provided their system-wide leak information.

Staff analyzed the data and requested supplementary information needed for clarification. The “Lessons Learned” section of this report identifies insights Staff acquired about potential improvements to the process and opportunities to enhance future data requests.

Basis for Adjusting the 2015 Baseline Values

Since the beginning of the NGLA reporting process, Staff and respondents have identified opportunities for improving reporting methodology, emission factors, and record keeping. Had some of these improved emissions data been known or used at the time of the 2015 reporting year they would have had a material impact on the level of 2015 Baseline emissions in the Joint Report.

While the June 2017 Commission D.17-06-015 does not order a process for updating the 2015 Baseline, it does order that:

“The Natural Gas Leak Abatement Program Annual Reporting Framework contained in Section 5.2 ... of this decision is adopted consistent with the process detailed below: The Commission’s Safety and Enforcement Division (SED), in consultation with the Air Resources Board [C](ARB), shall direct the annual report process...”¹⁸

This is interpreted to include the consideration and evaluation of any changes to 2015 Baseline emissions based on new methods of emissions accounting, better record keeping and information, and updated factors used for estimating emissions.

D.19-08-020 modifies the approach to updating EFs by allowing gas companies to propose EF changes that more accurately account for the emissions from their Compliance Plan emissions mitigation programs. In addition, changes to 2015 Baseline EFs may be warranted based on the supporting data and evidence used to develop EFs for emission mitigation programs included in their Compliance Plans.

The discussion within D.17-06-015 further clarifies the roles and responsibilities for managing the emissions reporting processes.

“...[T]he development of EFs and an official Baseline to manage this initiative in the long term is still in flux. Therefore, while, [C]ARB is ultimately responsible for the development of EFs in collaboration with stakeholders, both [C]ARB and CPUC should continue to collaborate to ensure that updates to EFs are completed in a timely fashion consistent with the Commission’s annual reporting process. Following this year’s example, if changes are required to the annual reporting template, [C]ARB and CPUC Staff will conduct a workshop to discuss EFs and ongoing changes to

¹⁸ D.17-06-015, pg. 157.

the reporting template. This workshop should take place during the first quarter of each year before SED issues the annual data request at the end of the first quarter.”¹⁹

In the 2021 Winter Workshop, the CPUC delivered a presentation titled “Baseline Adjustments” which reviewed the background, goals, considerations for changes to the 2015 Baseline emissions, and quantification of prior year amounts. This process of review is ongoing and will likely include an additional presentation at the 2022 Winter Workshop.

¹⁹ Ibid, pg. 39.

Findings and Discussion

Natural Gas Leaks and Emissions

As described in the Executive Summary, the 2020 estimated natural gas emissions totaled approximately 5,674 MMscf, which equates to 2.54 MMTCO₂e using the Intergovernmental Panel on Climate Change (IPCC) Forth Assessment Report (AR4) 100- year methane Global Warming Potential (GWP) of 25, or 7.32 MMTCO₂e using the 20-year methane GWP of 72 (see Table 1). This is a 1% YOY decrease from the 2019 estimated natural gas emissions of 5,710 MMscf.

System-wide Leak Rate

The System-wide Leak Rate is an important metric that shows the relative natural gas emissions to throughput from all respondents. SB 1371 requires annual monitoring of a System-wide Leak Rate for the transmission and distribution system.^{20,21}

Last year's 2020 Joint Report showed an increase in the System-wide Leak Rate from around 0.33% for the years 2015 through 2018 to 0.39% in 2019. This year, Staff worked together with PG&E to revise the 2019 reporting of the category, "Total Transmission Volume of Gas Transported to or for Customers in State." This category accounts for the transmission volume that is moved through the transmission pipelines that exits into a change of ownership with other transmission pipelines as well as the transmission volume that exits through depressurization into distribution pipelines. To correct the data reporting for 2019, Staff included an additional 477,333,366 Mscf in the throughput of the category "Total Transmission Volume of Gas Transported to or for Customers in State." This decreases the System-wide Leak Rate from the previous posting of 0.39% for 2019 to 0.29%.

This year's reporting of the 2020 System-wide Leak Rate in Table 4 shows a system-wide leak rate of 0.29%, which is the same as last year's corrected rate.

²⁰ For the purposes of SB 1371, the definitions of "leak" and "gas -loss" and the formula for calculating a "System-wide Leak Rate" were defined in a different manner than elsewhere. For the purposes of calculating the System-wide Leak Rate, a "leak" was defined as any breach, whether intentional or unintentional, whether hazardous or non-hazardous, of the pressure boundary of the gas system that allows natural gas to leak into the atmosphere. Any vented or fugitive emission to the atmosphere is considered a "leak." See Appendix B.

²¹ Refer to Appendix C for Public Utilities Code Section 975(e)(6), Article 3.

Table 4: System-wide Emissions – Throughput Categories, 2015 through 2020						
Throughput Category	Natural Gas Volume (MMscf)					
	2015 Baseline	2016	2017	2018	2019	2020
Total Storage Annual Volume of Injections to Storage	199,522	116,579	155,272	137,122	213,772	182,841
Total Storage Annual Volume of Gas Used by the Gas Department	N/A	N/A	1,933	1,782	2,409	1,803
Total Transmission Annual Volume of Gas Used by the Gas Department	7,717	6,107	5,875	6,185	7,080	6,951
Total Transmission Volume of Annual Gas transported to or for Customers in state	1,832,676	1,736,336	1,842,669	1,621,332	1,751,440	1,745,839
Total Transmission Volume of Annual Gas transported for Customers out of state	16,775	18,002	11,241	11,665	12,553	12,567
Total Distribution Annual Volume of Gas Used by the Gas Department	261	156	315	320	369	362
Total Throughput	2,056,950	1,877,179	2,017,306	1,778,406	1,987,623	1,950,363
Total Emissions	6,601	6,267	6,398	5,964	5,710	5,674
System-wide Leak Rate <i>($\frac{\text{Total Emissions}}{\text{Total Throughput}}$)</i>	0.32%	0.33%	0.32%	0.34%	0.29%	0.29%

The values of the five throughput categories show similar volumes in 2020 as compared to 2019. Staff looks forward to future discussions with gas companies to understand the implications of a systemwide leak rate of 0.29%.

2019 Data Adjustments and Corrections

This report reflects adjustments to the 2019 data reported in the 2020 Joint Report. The change in emission accounting in the 2019 respondent filings were updated for consistency and comparability with the current 2020 data. Staff reviewed with gas companies to confirm changes to the 2019 data.

The corrections made to 2019 values include:

- PG&E changed the 2019 value:
 - Distribution Mains and Services Pipelines, Pipeline Leaks subcategory decreased by 75,558 Mscf from 626,006 Mscf to 550,448 Mscf. This change resulted from PG&E’s Gas Curb Valve Box Leak Emission Analysis.
- SoCalGas changed the following 2019 values:
 - Transmission M&R Stations, Station Leaks and Emissions subcategory decreased by 133,498 Mscf from 242,239 Mscf to 108,741 Mscf. This change resulted from moving the

approximately equivalent amount of emissions of 137,445 Mscf attributed to 11,266 Tap Facilities from being accounted for within Transmission M&R Stations emissions to Distribution M&R Stations emissions, as well as moving the Direct Sales emissions to be accounted for in Customer Meters.

- Transmission M&R Stations, Blowdowns subcategory decreased by 8 Mscf from 1,482 Mscf to 1,474 Mscf. SoCalGas noted that tap facilities blowdown activities were also moved.
 - Distribution Mains and Services Pipelines, Pipeline Leaks subcategory increased by 3,432 from 547,954 Mscf to 551,386 Mscf.
 - Distribution Mains and Services Pipelines, Blowdowns subcategory increased by 9 Mscf from 287 Mscf to 296 Mscf.
 - Customer Meters, All Damages subcategory increased by 4,226 Mscf from 11,405 Mscf to 15,631 Mscf.
- San Diego Gas & Electric (SDG&E) changed the following 2019 values:
 - Transmission M&R Stations, Station Leaks and Emissions subcategory decreased by 244 Mscf from 25,121 Mscf to 24,877 Mscf. The adjustment was due to removing the Direct Sales emissions since Direct emissions are accounted for in Customer Meters emissions.
 - Distribution Mains and Services Pipelines, All Damages subcategory increased by 619 from 8,791 Mscf to 9,410 Mscf.

Impacts of CARB's Oil and Gas Methane Regulation

CARB's Oil and Gas Methane Regulation²² became effective January 1, 2018, and 2020 was its third year of implementation. The rule has impacted SB 1371 related efforts by increasing leak survey frequency at transmission compressor stations and storage facilities to a quarterly cycle and requiring repair within specified timeframes of components found to be leaking above the allowed threshold. In 2020, the COGR leak concentration threshold decreased from 10,000 ppm to 1,000 ppm. In 2020 leak surveys, PG&E reported an increased number of leaks relative to 2019, while SoCalGas reported fewer leaks in 2020 compared to 2019.

Both SB 1371 and COGR require descriptive entries, such as compressor facility name, types of compressors, and facility address. The data collected under SB 1371 are used to determine the total annual emissions, whereas COGR collects and evaluates quarterly reports of compressor component leaks to determine whether the reported leaks exceed the concentration thresholds. COGR also requires annual emissions flow rate measurements from reciprocating compressor rod packing and centrifugal compressor wet seals to verify emissions are below the allowable leak rates. If component leaks or compressor emission rates exceed the thresholds in COGR, operators are required to complete repairs within the timeframes specified in the rule.

²² The CARB Oil and Gas Methane Regulation is promulgated under 17 California Code of Regulations (CCR), Division 3, Chapter 1, Subchapter 10, Article 4, Subarticle 13.

In the reporting of data for SB 1371, both PG&E and SoCalGas described how COGR affected their emission totals and leak counts. The following provides a summary for the two companies' reporting of Transmission Compressor Stations and Underground Storage.

PG&E described in their supplemental questionnaire that the utility has continued various measures to reduce methane leaks and emissions, such as COGR, and implemented key leak abatement programs. The decrease in the leak concentration threshold in COGR from 10,000 ppm to 1,000 ppm resulted in a larger number of leaks being found and an associated increase in reported emissions. In addition to the increase in average repair time because of fewer staff being available for repairs due to COVID, PG&E claimed the increase in the total number of leaks possibly contributed to the observed increase in average repair time."

For PG&E's Component Leaks subsection of Transmission Compressor Stations, the emissions increased from 4,374 Mscf in 2019 to 11,356 Mscf in 2020. The leak count also increased from 457 leaks identified in 2019 to 1,025 leaks in 2020.

For PG&E's Storage Leaks and Emissions subsection of Underground Storage, the emissions increased from 1,824 Mscf in 2019 to 2,584 Mscf in 2020. The leak count also increased from 472 leaks identified in 2019 to 947 leaks in 2020. Finally, the average leak repair time increased from 12.6 days in 2019 to 20.6 days in 2020.

For PG&E's Component Leaks subsection of Underground Storage, the emissions increased from 769 Mscf in 2019 to 2,222 Mscf in 2020. The leak count also increased from 39 leaks identified in 2019 to 71 leaks in 2020.

SoCalGas described in their data reporting that the natural gas underground storage facility monitoring requirements in COGR have superseded the local air district's daily well inspection program. Additionally, in 2020, SoCalGas claimed the reduction in the COGR leak concentration threshold from 10,000 ppm to 1,000 ppm resulted in a lower leak count of leaks greater than 10,000 ppm due to addressing and repairing leaks detected at 1,000 ppm.

For SoCalGas's Component Leaks subsection of Transmission Compressor Stations, the emissions decreased from 5,858 Mscf in 2019 to 2,527 Mscf in 2020. The leak count also decreased from 276 leaks identified in 2019 to 153 leaks in 2020.

For SoCalGas's Storage Leaks and Emissions subsection of Underground Storage, the emissions decreased from 109 Mscf in 2019 to 59 Mscf in 2020. The leak count also decreased from 942 leaks identified in 2019 to 134 leaks in 2020.

For SoCalGas's Component Leaks subsection of Underground Storage, the emissions decreased from 14,181 Mscf in 2019 to 4,073 Mscf in 2020. The leak count also decreased from 719 leaks identified in 2019 to 284 leaks in 2020.

Summary of Gas Company– Estimated Natural Gas Emissions

In 2020, the overall natural gas emissions decreased 1% from 2019. Table 5 shows the YOY change in natural gas emissions for each gas company from 2019 to 2020. Table 5 also highlights that the four largest gas companies are responsible for approximately 99% of the total natural gas emissions in 2019 and 2020, while the remaining six gas companies account for approximately 1% of the total natural gas emissions. Changes in natural gas emissions for individual gas companies from 2019 to 2020 are described in this section.

Entity	2015 Baseline		2019		2020		2015 Baseline to 2020 Change		2019-2020 YOY Change	
	Mscf	% Total	Mscf	% Total	Mscf	% Total	Mscf	% Change	Mscf	% Change
Pacific Gas & Electric	3,294,368	50%	3,024,866	53%	3,045,879	54%	(248,489)	(8%)	21,013	1%
Southern California Gas	2,779,853	42%	2,165,773	38%	2,121,920	37%	(657,933)	(24%)	(43,853)	(2%)
San Diego Gas & Electric	282,041	4%	253,460	4%	245,671	4%	(36,370)	(13%)	(7,789)	(3%)
Southwest Gas	214,309	3%	220,891	4%	222,328	4%	8,019	4%	1,437	1%
Wild Goose Storage	24,003	0.36%	19,771	0.35%	19,676	0.35%	(4,327)	(18%)	(95)	(0%)
Gill Ranch Storage	3,636	0.06%	19,008	0.33%	14,401	0.25%	10,765	296%	(4,607)	(24%)
Lodi Gas Storage	1,638	0.02%	4,071	0.07%	2,438	0.04%	800	49%	(1,633)	(40%)
Central Valley Gas Storage	806	0.01%	1798	0.03%	852	0.02%	46	6%	(946)	(53%)
West Coast Gas Company	509	0.01%	200	0.00%	224	0.00%	(285)	(56%)	24	12%
Alpine Natural Gas	6	0.00%	269	0.00%	247	0.00%	241	4,311%	(22)	(8%)
Total	6,601,169	100%	5,710,107	100%	5,673,636	100%	(927,533)	(14%)	(36,471)	(1%)

While natural gas emissions are expressed in units of MMscf in Tables 1 through 4 to provide a high-level overview of emissions, Tables 5 through 18 use units of thousands of standard cubic feet (Mscf) to provide additional detail, consistent with the units that gas companies reported in their submittals for Appendix 8 of the reporting template (Template Summary). Staff will consider presenting a slide at the 2022 Winter Workshop to inform respondents to report units rounded to the nearest 1 Mscf in future submittals for Appendix 8 of the reporting template to mitigate any rounding errors.

The following subsections provide a summary of the changes in natural gas emissions for each company by system category from 2019 to 2020. These summaries are based on information provided by respondents as part of their report filings, including gas company responses to Staff follow-up questions.

Pacific Gas and Electric (PG&E)

PG&E reported natural gas emissions of 3,045,879 Mscf in 2020, a YOY increase of 21,013 Mscf or approximately 1% from 3,024,866 Mscf reported for 2019.

Large YOY changes in emissions are summarized below by reporting category:

- Transmission Pipelines
 - Transmission pipelines emissions from all damages increased YOY by 2,602 Mscf from 1,420 Mscf reported for 2019 to 4,022 Mscf reported for 2020 (a 183% increase). This was largely due to damages in larger-sized transmission pipelines, not an increase in the count of damages. PG&E experienced three events in 2020 in which larger transmission pipelines were damaged. Through implementation of BP 24, PG&E continues efforts to mitigate pipeline dig-ins.
 - Transmission pipeline blowdown emissions increased YOY by 9,101 Mscf from 119,569 Mscf reported for 2019 to 128,670 Mscf reported for 2020 (an 8% increase). While PG&E continued to utilize techniques to reduce methane emissions from natural gas blowdowns such as cross-compression, bundling, flaring, and drafting, blowdown emissions increased because PG&E was unable to perform cross-compression on one backbone project due to COVID-19 restrictions. Cross-compression is a process by which natural gas is transferred from one pipeline to another during large pipeline construction and repair projects, reducing the amount of natural gas vented to the atmosphere by 75 to 90 percent.
 - Transmission pipelines component vented emissions increased YOY by 2,506 Mscf from 25,012 Mscf reported for 2019 to 27,518 Mscf reported for 2020 (a 10% increase). PG&E attributed this change to inclusion of automated valves in its inventory that were not previously reported.
- Transmission M&R Stations
 - Transmission M&R Station leaks and emissions decreased YOY by 25,145 Mscf from 572,435 Mscf reported for 2019 to 547,290 Mscf reported for 2020 (a 4% decrease). This reduction in emissions was attributed to transfer of farm taps from being reported within Transmission M&R station emissions in previous years to Distribution M&R station emissions in 2020. PG&E's Transmission M&R station count also decreased from 2,666 in 2019 to 352 in 2020 due to improvements in PG&E's reporting system as well as minor physical changes at stations in the field.
- Transmission Compressor Stations
 - Transmission Compressor Station vented emissions decreased YOY by 29,862 from 49,204 Mscf reported for 2019 to 19,342 Mscf in 2020 (a 61% decrease). PG&E attributed this decrease to an improvement in reporting practices. Depressurized idle measurements are

taken every 3 years per 17 CCR section 95153. For Mandatory Reporting of Greenhouse Gas Emissions (MRR), a three-year average emission factor by operating mode, for each compressor station is used to calculate emissions. In 2020, PG&E aligned the same emission calculation by averaging the measurements taken within the last 3 years for each compressor. For those measurements that are absent because they do not meet the MRR reporting threshold, PG&E used an average of all the compressor and storage facility emissions to calculate emissions. PG&E reported that this method provides a more accurate estimate of the emissions than the simple average used in previous years.

- The decrease in Transmission Compressor Station vented emissions was slightly offset by an increase in Transmission Compressor Station component leaks from 4,374 Mscf in 2019 to 11,356 Mscf in 2020. Compressor leaks and emissions increased because COGR repair requirements were updated to reflect a lower ppm threshold from 10,000 ppm to 1,000 ppm starting in January 2020. This resulted in an increase of 124% in the number of leaks reported at Compressor Stations.
- Distribution Main & Services Pipelines
 - DM&S pipeline leak emissions decreased by 47,721 Mscf YOY from 550,448 Mscf reported for 2019 to 502,727 Mscf reported for 2020 (a 9% decrease).
 - In 2020, PG&E completed a study that identified many leak indications that were found by traditional survey methods and were not predicted as part of the Risk Based Survey (RBS) model. These leaks were determined to be indications found in gas valve boxes (GVB) with low concentration measurements, not emitting methane to atmosphere, likely accumulated gas from a small release during the installation of the meter set and service or maintenance of the meter set service head adapter (“ghost leaks”). As a result of this study, PG&E removed these leaks and emissions from the leak population in 2020 and adjusted the number of unknown leaks.
 - PG&E also continued to implement its Super-Emitter leak survey and repair program in 2020, which aims to rapidly detect and repair leaks larger than 10 scfh pursuant BP-21. The mobile leak detection system identified 123 larger leaks (Super-Emitters) in 2020. As Super-Emitter leaks are found and repaired, there is less time for these large leaks to emit gas, resulting in emission reductions.
 - These reductions in emissions for DM&S pipelines were offset slightly by two factors that would increase emissions in this category.
 - In 2020, PG&E completed 1,255 belowground grade 3 leak repairs in 2020 and 645 belowground grade 3 leaks repairs in 2019, compared to 2,556 belowground grade 3 leak repairs in 2018. Fewer belowground grade 3 leak repairs contributed to the increase of the backlog grade 3 leaks and an associated increase in emissions, due to PG&E waiting for approval of their Compliance Plan from the CPUC.
 - There was also a decrease in the number of O&M leaks due to an improvement in characterizing customer calls within PG&E’s leak database that reduced the number of O&M leaks from approximately 3,000 to 800. The other 2,200 leaks were instead categorized within the “Found 2020” leak survey tab. This change increased reported

emissions since it resulted in more leaks found through surveys, which were assigned a duration starting from the beginning of the year, and fewer leaks categorized as O&M leaks, which were assigned a duration starting at the time of discovery.

- Overall, PG&E's leak counts across the various categories and total emissions look consistent year over year. There were about 1,000 more carryover leaks in 2020 than 2019, an approximate 10% increase (11,629 leaks for 2020 minus 10,656 leaks for 2019). Also, there were fewer grade 3 leaks discovered in 2020 (6,351 leaks in 2020 compared to 8,038 leaks in 2019). Finally, there were more grade 3 repairs performed in 2020 (1,271 repairs in 2020 compared to 693 in 2019.)
- Distribution M&R Stations
 - Distribution M&R Station Leaks and Emissions, Population-Based increased from 790,545 Mscf reported for 2019 to 883,459 Mscf in 2020.
 - PG&E also submitted emission estimates for Distribution M&R Stations using leaker-based emission factors for 2020. This information is shown in Appendix A.
 - In 2020, farm taps were transferred from Transmission to Distribution M&R Station emissions, resulting in an increase in Distribution M&R Station emissions. This increase balances the reduction in Transmission M&R Stations emissions.
- Customer Meters
 - Customer Meter Leaks, Population-Based emissions increased from 645,997 Mscf in 2019 to 650,385 Mscf in 2020.
 - PG&E observed an increase in the number of Customer Meter damages and the average time to repair damages increasing from 0.7 hours in 2019 to 0.9 hours in 2020 due to COVID-19.
 - PG&E also submitted emission estimates for Customer Meters using leaker-based emission factors for 2020. This information is shown in Appendix A.
- Underground Storage
 - Storage leaks and emissions increased by 760 Mscf YOY from 1,824 Mscf in 2019 to 2,584 Mscf in 2020 (a 41% increase). As with Compressor leaks, PG&E reported that Storage leaks and emissions also increased because COGR repair requirements were updated to reflect a lower ppm threshold from 10,000 ppm to 1,000 ppm starting in January 2020. This resulted in an increase of 82% in the number of leaks reported at Storage Facilities. This increase in leaks may have also contributed to the increased average repair time from 12.6 days in 2019 to 20.6 days in 2020, adding to the increase in emissions in this category.
 - Component emissions increased by 4,034 Mscf YOY from 73,761 Mscf in 2019 to 77,795 Mscf in 2020 because there were 366 days in 2020 compared to 365 in 2019.
 - Emissions from component leaks increased by 1,453 Mscf YOY from 769 Mscf in 2019 to 2,222 Mscf in 2020 (a 189% increase) because of the change in COGR requirements described.
 - These increases were somewhat offset by minor decreases in emissions from compressor emissions (264 Mscf decrease) and blowdowns (389 Mscf decrease).

Southern California Gas (SoCalGas)

SoCalGas reported natural gas emissions of 2,121,920 Mscf in 2020, a decrease of 43,853 Mscf from 2,165,773 Mscf reported for 2019. This approximately 2% YOY decrease in emissions was mostly attributed to SoCalGas's efforts to reduce transmission blowdown emissions and efforts to repair component leaks. These decreases were offset somewhat by a large increase in Transmission Compressor Station emissions.

Large YOY changes in emissions included the following, summarized by system category:

- Transmission Pipelines
 - Damage emissions increased to 9,692 Mscf in 2020, due to two third-party excavation damage events. No damage emissions were reported for 2019.
 - Blowdown emissions decreased 56,915 Mscf YOY from 132,921 Mscf reported for 2019 to 76,006 Mscf reported for 2020 (a 43% decrease). SoCalGas attributed this reduction to increasing the capabilities of the centralized organization responsible for planning, coordinating, and executing high-pressure pipeline blowdown reduction efforts. This allowed SoCalGas to bundle work on some high-pressure lines and coordinate blowdown reduction for high-pressure projects across departments.
- Transmission M&R Stations
 - Blowdown emissions decreased 1,463 Mscf YOY from 1,474 Mscf reported for 2019 to 11 Mscf in 2020.
 - SoCalGas reported that Station Leaks and Emission subcategory emissions were 108,741 Mscf in both 2020 and in 2019. Last year, SoCalGas had reported that emissions in this category were 242,239, representing a 133,498 Mscf or 55% reduction YOY from previous submitted data. This reduction is due to SoCalGas moving farm taps to be accounted for within Distribution M&R Station emissions and moving Direct Sales emissions to be accounted for within Customer Meter emissions instead of Transmission M&R Stations emissions. SoCalGas revised its 2019 total to allow a like-for-like comparison between 2019 and 2020.
- Transmission Compressor Stations
 - Transmission Compressor Station vented emissions increased 23,937 Mscf YOY from 3,914 Mscf reported for 2019 to 27,851 Mscf in 2020 (a 612% increase). SoCalGas made compressor rod packing replacements at two high-demand and high-speed units due to constraint on the system, leading to an increase in emissions.
 - Blowdown emissions increased 3,341 Mscf YOY from 13,825 Mscf reported for 2019 to 17,166 Mscf reported for 2020 (a 24% increase).
 - Component vented emissions increased 1,053 Mscf YOY from 4,287 Mscf reported for 2019 to 5,340 Mscf reported for 2020 (a 25% increase). SoCalGas reported that after completing asset verification projects of transmission compressor station components, SoCalGas identified 254 devices, compared to 206 reported in 2019, resulting in a higher but more accurate count and an associated increase in emissions.

- Emissions from Component Leaks decreased 3,331 Mscf YOY from 5,858 reported for 2019 to 2,527 Mscf reported for 2020 (a 57% reduction). In January 2020, COGR repair requirements were updated to reflect a lower ppm leak detection threshold from 10,000 ppm to 1,000. This led SoCalGas to address and repair when detected at 1,000 ppm faster, and a decrease in leaks > 10,000 ppm found.
- Distribution Mains & Services Pipelines
 - DM&S pipeline leak emissions decreased 5,957 Mscf YOY from 551,386 Mscf reported for 2019 to 545,429 Mscf reported for 2020 (a 1% decrease). SoCalGas moved from a three-year survey cycle to an annual survey cycle for Unprotected Steel Pipelines in 2020. This helps explain the increase in the number of known or discovered leaks from 17,427 in 2019 to 20,005 and the decrease in the number of unknown leaks from 2,204 in 2019 to 798 in 2020. Additionally, in 2020, more leaks were repaired than in 2019 (10,503 versus 8,392 leaks repaired) because of efforts to reduce the leak inventory (Best Practice 21).
 - Emissions from DM&S damages decreased 6,579 Mscf YOY from 80,244 Mscf in 2019 to 73,665 reported for 2020. While there were more damage events in 2020, they were overall smaller in severity, asset dimensions, and pressure than 2019.
- Distribution M&R Stations
 - DM&R Station Leaks and Emissions, Population-Based increased from 345,554 Mscf reported for 2019 to 346,494 Mscf reported for 2020.
 - As described above, SoCalGas moved farm taps to be accounted for within Distribution M&R Station emissions instead of Transmission M&R Stations for 2019 and 2020.
 - SoCalGas also submitted emission estimates for Distribution M&R Stations using leaker-based emission factors for 2020 and revised their 2019 emissions data to reflect this change to allow for a like-for-like YOY comparison. This information is shown in Appendix A.
- Customer Meters
 - Meter leaks increased 5,451 Mscf YOY from 865,784 Mscf reported for 2019 to 871,235 Mscf reported for 2020, due to an increase in number of meters. Next year, SoCalGas anticipates transiting from using population-based emission factors to a leaker-based approach to estimate Customer Meter leaks and emissions.
- Underground Storage
 - Underground storage blowdown emissions decreased 1,914 Mscf YOY from 3,697 Mscf reported for 2019 to 1,783 Mscf reported for 2020 (a 52% decrease). SoCalGas attributed the reduction to efforts to depressurize the line by routing the gas to either distribution or transmission systems and storing gas in a utility truck to reduce the amount of gas that is vented to the atmosphere.
 - Component vented emissions decreased 1,429 Mscf YOY from 4,202 Mscf reported for 2019 to 2,773 Mscf reported for 2020 (a 34% decrease). SoCalGas attributed emissions reductions to decommissioning components, converting components to nitrogen, or converting components to air components.

- Component leaks decreased 10,108 Mscf YOY from 14,181 Mscf reported for 2019 to 4,073 Mscf reported for 2020 (a 71% decrease). As with Transmission Compressor Station component leaks, this reduction COGR repair requirements that were updated in January 2020 to reflect a lower ppm leak detection threshold from 10,000 ppm to 1,000. This led SoCalGas to address and repair leaks when detected at 1,000 ppm faster and a lower count of leaks > 10,000 ppm discovered.

San Diego Gas and Electric (SDG&E)

SDG&E reported natural gas emissions of 245,671 Mscf in 2020, a decrease of 7,789 Mscf from 253,460 Mscf reported for 2019. Most of this decrease is attributed to efforts to reduce and better estimate transmission M&R station leaks and emissions and DM&S pipeline leaks.

Large YOY changes in emissions included the following, summarized by reporting category.

- Transmission M&R Stations
 - Station leaks and emissions decreased 3,110 YOY from 24,877 Mscf reported for 2019 to 21,767 Mscf reported for 2020 (a 13% decrease). SDG&E explained that personnel visited each M&R station to verify and update asset information through Assets Field Verification work performed to implement BP 9, finding that the number of facilities had previously been overreported due to duplicate entries and inconsistent naming conventions. The led to a decrease in number of facilities and associated emissions.
- Transmission Compressor Stations
 - Blowdown emissions decreased 814 Mscf YOY from 2,521 Mscf reported for 2019 to 1,707 Mscf reported for 2020 (a 32% decreased).
 - Component vented emissions decreased 53% YOY (461 Mscf reduction) because of field verification efforts that resulted in a lower but more accurate component count.
 - Storage tank leaks and emissions decreased 61% YOY because of an improved procedure for maintaining the vacuum insulation of the tanks. There was also a YOY reduction in count of leaks from 238 to 68.
- Distribution Mains & Services
 - Pipeline leaks decreased 2,449 Mscf YOY from 6,031 Mscf reported for 2019 to 3,582 Mscf reported for 2020 (a 41% decrease). In 2020, SDG&E increased Leak Survey cycles on vintage Protected Steel material (installed before 1950) to annual survey cycles. The YOY emissions decrease is attributed to the reduction in number of unknown leaks (from 148 unknown leaks in 2019 to 58 in 2020).
 - Blowdown emissions decreased 1,344 Mscf YOY from 1,369 Mscf reported in 2019 to 25 Mscf reported for 2020 (a 98% decrease). Higher emissions in 2019 were a result of Pipeline Safety Enhancement Plan projects.

- Distribution Metering and Regulating Stations
 - DM&R Station Leaks and Emissions, Population-Based decreased slightly from 75,675 Mscf reported for 2019 to 75,599 Mscf reported for 2020.
 - SDG&E also submitted emission estimates for Distribution M&R Stations using leaker-based emission factors for 2020 and revised 2019 emissions data. This information is shown in Appendix A.
- Customer Meters
 - Meter leaks increased slightly from 129,326 Mscf reported in 2019 to 130,298 Mscf reported for 2020, due to an increase in number of meters. Next year, SDG&E anticipates transiting from using population-based emission factors to a leaker-based approach to estimate Customer Meter leaks and emissions.

Southwest Gas (SWG)

SWG reported 220,891 Mscf of natural gas emissions in 2020, a slight increase of 1,437 Mscf from 220,891 Mscf reported for 2019 (a 1% increase).

- Transmission M&R Stations
 - Station leaks and emissions decreased 1,555 Mscf YOY from 15,548 Mscf reported for 2019 to 13,993 Mscf reported for 2020 (a 10% decrease). This reduction is attributed to SWG retiring one Transmission M&R station in 2020.
- Distribution Mains & Services
 - Emissions from DM&S pipeline damages increased 645 Mscf YOY from 555 Mscf reported in 2019 to 1,199 Mscf reported for 2020 because more damages were experienced in 2020 (a 116% increase).
- Distribution Metering and Regulating Stations
 - Station leaks and emissions increased by 2,327 Mscf YOY from 173,190 Mscf reported in 2019 to 175,518 Mscf reported for 2020 (a 1% increase). SWG added three new stations and retired seven stations in 2020, leading to an overall reduction in the number of stations. However, there was a YOY increase in emissions because two of the newer stations were larger than those they replaced, and therefore had higher emission factors.
- Customer Meters
 - There was a slight increase of 286 Mscf YOY from 28,994 Mscf reported for 2019 to 29,280 Mscf reported for 2020 due to new meters being added to the system.

Wild Goose Gas Storage (WGGGS)

WGGGS's natural gas emissions decreased slightly from 19,771 Mscf reported in 2019 to 19,676 Mscf reported in 2020, a 94 Mscf reduction, or less than 1% YOY reduction. All natural gas emissions from WGGGS are associated with underground storage, and summarized as follows:

- Emissions from Underground storage component leaks increased 382 Mscf from 904 Mscf reported in 2019 to 1,286 reported in 2020 (a 42% increase).
- Compressor emissions and storage leaks and emissions also increased slightly.
- These increases were outweighed by a 547 Mscf decrease in blowdowns from 12,608 Mscf reported for 2019 to 12,061 Mscf reported for 2020 (-4% change).

Gill Ranch Gas Storage Company (GRGC)

In 2020, GRGC reported natural gas emissions of 14,401 Mscf, a 4,607 Mscf decrease from the 19,008 reported for 2019. This approximately 24% YOY reduction was due to the following changes in emission subcategories:

- Underground storage compressor emissions decreased from 10,638 reported for 2019 to 10,019 reported for 2020 (6% reduction). GRGC increased the compressor start-up pressure from 470 psi to 600 psi, which resulted in approximately 11 Mscf reduction per compressor start-up.
- Underground storage blowdowns decreased from 6,988 reported for 2019 to 4,259 reported for 2020 (39% reduction) because 63 compressor start-ups after June 29, 2020, did not require a blowdown.
- Underground storage component emissions decreased from 867 Mscf reported for 2019 to 0 reported for 2020 (a 100% reduction) because GRGC used nitrogen instead of natural gas for their controllers, eliminating associated emissions.
- Underground storage component leaks decreased from 515 reported for 2019 to 123 reported for 2020 (a 76% reduction).

Lodi Gas Storage (LGS)

LGS observed a reduction in natural gas emissions from 4,071 Mscf in 2019 to 2,438 Mscf in 2020 (a 40% reduction). This reduction was due to the following changes in emissions:

- Transmission pipeline blowdown emissions decreased from 16 Mscf in 2019 to 2 Mscf in 2020 (an 87% reduction) because there were no large blowdown events in 2020.
- Underground storage leaks and emissions decreased from 227 Mscf in 2019 to 3 Mscf in 2020 (a 94% reduction) because there were no large emission well site leaks in 2020.
- Underground storage compressor emissions decreased from 2,949 Mscf in 2019 to 1,629 Mscf in 2020 (a 45% reduction) because of a decrease in compressor runtime from 2019 to 2020. The total hours of pressurized operating mode of the compressors decreased from 11,491 hours in 2019 to 7,436 hours in 2020.
- Underground Storage blowdown emissions decreased from 202 Mscf in 2019 to 116 Mscf in 2020 (a 43% reduction) because of a decrease in blowdown events from 2019 to 2020.

Central Valley Gas Storage (CVGS)

CVGS reported natural gas emissions of 852 Mscf for 2020, a YOY 946 Mscf decrease from the 1,798 Mscf reported for 2019. This approximately 53% reduction was due to the following changes in emissions:

- Underground storage compressor emissions decreased YOY by 593 Mscf from 1,206 reported for 2019 to 613 reported for 2020 (a 49% reduction). The decrease was because CVGS replaced its compressor rod packing on one of its compressors in 2019 with a new style, significantly reducing emissions on the unit in 2020. CVGS has now replaced two of three of their compressors with the new style.
- Underground storage blowdown emissions decreased YOY by 356 Mscf from 563 reported for 2019 to 207 reported for 2020 (a 63% reduction). CVGS is taking steps to reduce emissions from well work required by a new California Geologic Energy Management Division (CalGEM) regulation. In 2020, work on one of CVGS's largest wells was expected to require a blowdown releasing 80 mcf of gas, but CVGS mitigated emissions by electing to flare the gas instead of releasing it.

West Coast Gas Company (WCGC)

WCGC's natural gas emissions increased slightly from 200 Mscf reported from 2019 to 224 Mscf reported for 2020. This YOY increase of 24 Mscf was due to an increase of two additional DM&S pipeline leaks discovered in 2020 (three leaks in 2020 versus one leak in 2019).

Alpine Natural Gas

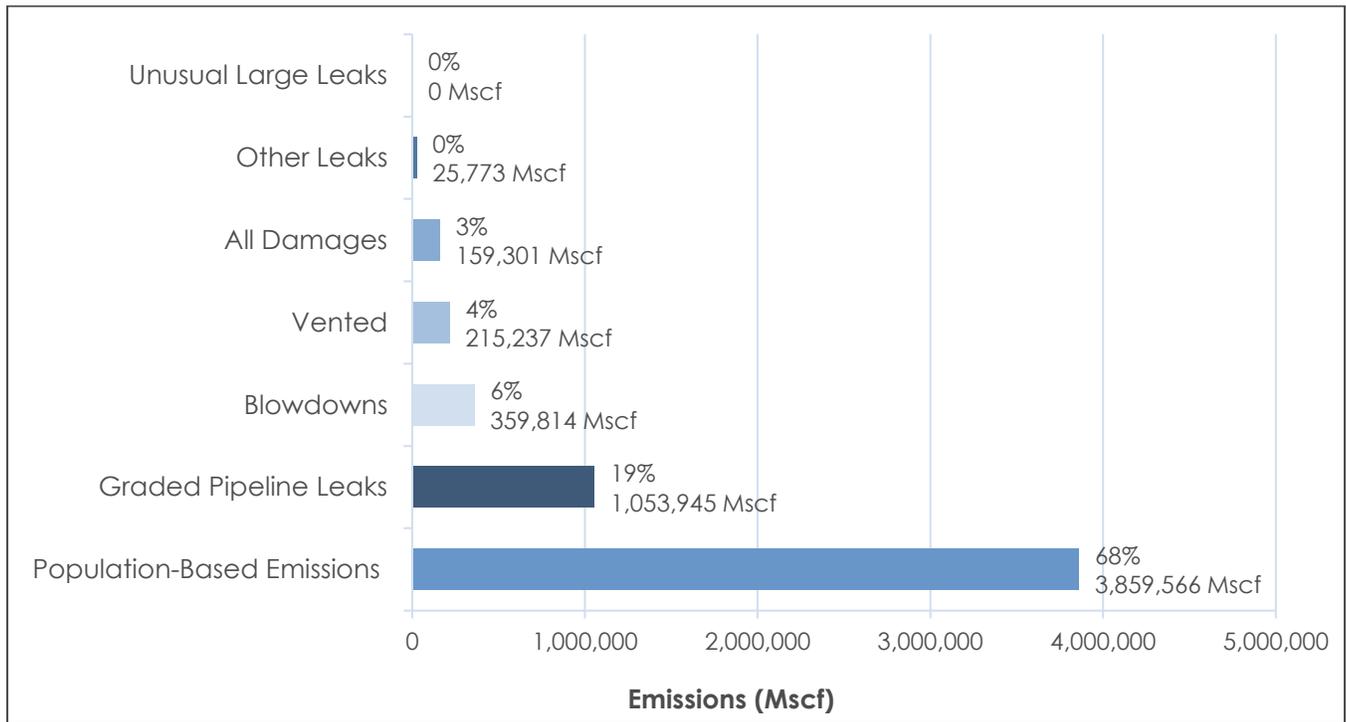
Alpine Natural Gas reported natural gas emissions of 247 Mscf in 2020, a YOY 22 Mscf decrease from the 269 Mscf reported for 2019. Most of Alpine Natural Gas' emissions (245 Mscf) in 2020 were from Customer Meter fugitive leaks, consistent with prior years. In 2020, there were fewer damages and associated emissions to repair the damages compared to 2019.

There were no changes to Alpine Natural Gas' leak and emission management practices in 2021. The gas company's emissions remain relatively constant YOY with minor fluctuations due to a changing number of pipeline leaks and pipeline damages due to accidental dig-ins.

Summary of Natural Gas Emissions Grouped by Source Classification

As described in the Executive Summary, the natural gas emissions can be grouped and evaluated by source classification, which has been useful for helping gas companies identify strategies to reduce emissions. For example, natural gas emissions reductions in in population-based source classifications can only be achieved through reducing the number of pieces of equipment. However, in other source classifications in which leaks are measured, natural gas emissions reductions can be achieved through strategies that reduce the measured leaks while keeping the same number of pieces of equipment. While Table 3 in the Executive Summary provides a data analysis with 2019 natural gas emissions data, Figure 1 provides a graphical view of the natural gas emissions by source classification.

Figure 1: 2020 Natural Gas Emissions Grouped by Source Classification (% of Total and Mscf)



Population-based natural gas emissions are the largest source classification with 3,859, 566 Mscf in 2020. To provide a more detailed analysis of population-based emissions, Table 6 shows the four individual emission sources that are part of this source classification.

Population-based natural gas emissions, which are calculated based on the number of units within a system category multiplied by an emission factor (EF), stay constant unless a change is made to the number of units, the EFs, or both.²³ The two largest sources in 2020, Customer Meters and Distribution M&R Stations, are undergoing significant changes with the development of methodological changes for estimating natural gas emissions. These changes are described in Appendix A but are not shown in this section.

²³ See Table 6 for a breakdown on the system categories making up Population-Based Emissions.

Table 6: Population-Based Natural Gas Emissions							
System Category, Population-Based Emissions	2015 Baseline [Mscf]	2019 [Mscf]	2020 [Mscf]	2015 Baseline to 2020 Change		2019 - 2020 YOY Change	
				Mscf	% Change	Mscf	% Change
Transmission Pipelines, Pipeline Leaks	5,238	5,068	5,047	(191)	(4%)	(21)	(0%)
Transmission M&R Stations, Station Leaks & Emissions	941,622	721,622	691,812	(249,810)	(27%)	(29,810)	(4%)
Distribution M&R Stations, Station Leaks & Emissions	1,347,773	1,384,964	1,481,070	133,297	10%	96,106	7%
Customer Meters, Meter Leaks	1,635,911	1,670,536	1,681,637	45,726	3%	11,101	1%
Total Population-Based Emissions	3,930,544	3,782,190	3,859,566	(70,978)	(2%)	77,376	2%

The next largest source classification, Graded Pipeline Leaks, is described later in the report in the section that analyzes the results of Distribution Mains and Services.

The third largest source classification with 359,814 Mscf in 2020 is Blowdowns. Table 7 shows Blowdown emissions by system category. This source classification experienced a 13% decrease of 54,379 Mscf from 2019. The decrease from the 2015 Baseline emissions of 603,425 Mscf or 40% is primarily due to project bundling and implementation of cross-compression practices, which move natural gas that would otherwise be vented to an adjacent pipeline.

Table 7: Blowdown Natural Gas Emissions							
System Category	2015 Baseline [Mscf]	2019 [Mscf]	2020 [Mscf]	2015 Baseline to 2020 Change		2019 - 2020 YOY Change	
				Mscf	% Change	Mscf	% Change
Transmission Pipeline	455,055	252,715	205,220	(249,835)	(55%)	(47,495)	(19%)
Transmission M&R Stations	65,583	68,586	68,312	2,729	4%	(274)	(0%)
Transmission Compressor Stations	31,088	55,233	55,956	24,868	80%	723	1%
Distribution Mains and Services	5,046	1,869	492	(4,554)	(90%)	(1,377)	(74%)
Distribution M&R Stations	295	370	435	140	47%	65	18%
Underground Storage	46,358	35,420	29,399	(16,959)	(37%)	(6,021)	(17%)
Total	603,425	414,193	359,814	(243,611)	(40%)	(54,379)	(13%)

The fourth largest source classification with 215,237 Mscf in 2020 is Vented natural gas emissions. Table 8 shows the detail composition of Vented emissions. This classification includes the controlled release of natural gas from pneumatic devices across the various stages of the transmission, storage, and distribution.

Table 8: Vented Natural Gas Emissions							
System Category	2015 Baseline [Mscf]	2019 [Mscf]	2020 [Mscf]	2015 Baseline to 2020 Change		2019 - 2020 YOY Change	
				Mscf	% Change	Mscf	% Change
Transmission Pipelines, Components	4,592	32,177	33,888	29,296	638%	1,711	5%
Transmission Pipelines, Odorizers	2,570	2,941	2,888	318	12%	(53)	(2%)
Transmission M&R Stations, Components	21	N/A	N/A	(21)	N/A	N/A	N/A
Transmission Compressors Stations, Compressors	106,257	54,165	48,060	(58,197)	(55%)	(6,105)	(11%)
Transmission Compressors Stations, Components	7,186	23,661	24,189	17,003	237%	528	2%
Distribution Mains & Services, Components	3,281	0	0	(3,281)	(100%)	0	N/A
Customer Meters, Vented	2,363	1,056	884	(1,479)	(63%)	(172)	(16%)
Underground Storage, Compressors	96,313	27,432	24,621	(71,692)	(74%)	(2,811)	(10%)
Underground Storage, Components	14,947	78,956	80,694	65,747	440%	1,738	2%
Underground Storage, Dehydrator Vented	20,163	12	13	(20,150)	(100%)	1	8%
Total	257,693	220,400	215,237	(42,456)	(16%)	(5,163)	(2%)

The next category, All Damages, remained relatively constant from 153 MMscf in 2019 to 159,301 Mscf in 2020. This includes damages from individuals and construction companies to transmission pipelines, distribution pipelines, and customer meters. Gas companies have mentioned in their best practices submittal that they fund communication and educational campaigns to encourage individuals to contact the company before digging.

The final source classification, Other Leaks, decreased from 30,005 Mscf in 2019 to 25,773 in 2020. This category includes Component Leaks in DM&S, and Underground Storage, as well as Storage Leaks and Emissions in Underground Storage.

Detailed Natural Gas Emissions

Detailed Natural Gas Emissions by System Category, Emission Source, and Source Classification

Table 9 summarizes and compares the 2015 Baseline, 2019, and 2020 natural gas emissions by system category, emission source, and source classification. In some cases, “N/A” is designated to show under a reporting year that the category was not available due to not being part of the template at that time. In other cases, “N/A” is used under the four rightmost columns to show that the emission total or percent change could not be calculated due to division by zero or because a category was not part of the template.

Table 9: Detailed Natural Gas Emissions (System Category, Emission Source, and Source Classification)									
System Category	Emission Source	Source Classification	2015 Baseline	2019	2020	2015 Baseline to 2020 Change		2019 - 2020 YOY Change	
			Mscf	Mscf	Mscf	Mscf	%	Mscf	%
Transmission Pipelines	Pipeline Leaks	Population-Based	5,238	5,068	5,047	(191)	(4%)	(21)	(0%)
	All Damages	Damages	81,793	1,420	13,714	(68,079)	(83%)	12,294	866%
	Blowdowns	Blowdown	455,055	252,715	205,220	(249,835)	(55%)	(47,495)	(19%)
	Component Emissions	Vented	4,592	32,177	33,888	29,296	638%	1,711	5%
	Odorizers	Vented	2,570	2,941	2,888	318	12%	(53)	(2%)
Transmission M&R Stations	Station Leaks & Emissions	Population-Based	941,622	721,622	691,812	(249,810)	(27%)	(29,810)	(4%)
	Blowdowns	Blowdown	65,583	68,586	68,312	2,729	4%	(274)	(0%)
	Component Emissions	Vented	21	N/A	N/A	(21)	N/A	0	N/A
Transmission Compressor Stations	Compressor Emissions	Vented	106,257	54,156	48,060	(58,197)	(55%)	(6,096)	(11%)
	Blowdowns	Blowdown	31,088	55,233	55,956	24,868	80%	723	1%
	Component Emissions	Vented	7,186	23,661	24,189	17,003	237%	528	2%
	Component Leaks	Other Leaks	18,153	10,616	14,251	(3,902)	(21%)	3,635	34%
	Storage Tank Leaks & Emissions	Other Leaks	3	183	470	467	15,567%	287	157%
Distribution Mains & Services	Pipeline Leaks	Pipeline Leaks	1,458,399	1,110,270	1,053,945	(404,454)	(28%)	(56,325)	(5%)
	All Damages	Damages	236,145	130,463	123,878	(112,267)	(48%)	(6,585)	(5%)
	Blowdowns	Blowdown	5,046	1,869	492	(4,554)	(90%)	(1,377)	(74%)
	Component Emissions	Vented	3,281	0	0	(3,281)	(100%)	0	N/A
	Component Leaks	Other Leaks	N/A	0	1	1	N/A	1	N/A
Distribution M&R Stations	Station Leaks & Emissions	Population-Based	1,347,773	1,384,964	1,481,070	133,297	10%	96,106	6.9%
	Blowdowns	Blowdown	295	50	0	(295)	(100%)	(50)	(100%)
	All Damages	Damages	N/A	370	435	435	N/A	65	18%
Customer Meters	Meter Leaks	Population-Based	1,635,911	1,670,536	1,681,637	45,726	3%	11,101	0.7%
	All Damages	Damages	N/A	21,125	21,709	21,709	N/A	584	3%
	Vented Emissions	Vented	2,363	1,056	884	(1,479)	(63%)	(172)	(16%)
Underground Storage	Storage Leaks & Emissions	Other Leaks	15,016	2,160	2,669	(12,347)	(82%)	509	23.6%
	Compressor Emissions	Vented	96,313	27,432	24,621	(71,692)	(74%)	(2,811)	(10%)
	Blowdowns	Blowdown	46,358	35,420	29,399	(16,959)	(37%)	(6,021)	(17%)
	Component Emissions	Vented	14,947	78,956	80,694	65,747	440%	1,738	2%
	Compressor & Component Leaks	Other Leaks	N/A	17,046	8,382	8,382	N/A	(8,664)	(51%)
	Dehydrator Vent Emissions	Vented	20,163	12	13	(20,150)	(100%)	1	8%
Total			6,601,171	5,710,107	5,673,636	(927,535)	(14.1%)	(36,471)	(1%)

Detailed Discussion for Each of the Seven System Categories

Transmission Pipelines

PG&E, SoCalGas, SDG&E, LGS, and CVGS reported Transmission Pipelines natural gas emissions. The total natural gas emissions decreased from 294,321 Mscf in 2019 to 260,757 Mscf in 2020, with most of the decrease attributed to reductions in blowdown emissions.

- Pipeline Leaks decreased 21 Mscf from 5,068 Mscf in 2019 to 5,047 Mscf in 2020. Typically, emissions for this category have remained constant because the emissions are based on the miles of transmission pipelines, which does not vary much YOY.
- In 2020, All Damages increased by 12,294 Mscf from 1,420 Mscf in 2019 to 13,714 Mscf in 2020. These emissions are event-based and can fluctuate significantly from year-to-year.
- Blowdowns showed a noticeable YOY reduction of 47,495 Mscf from 252,715 Mscf in 2019 to 205,220 Mscf in 2020. There are several factors affecting blowdowns and the potential for YOY fluctuations, including the cyclical nature of O&M; the ability to bundle projects; the amount of pipeline replacement; the size, length and pressure of the pipelines affected; and the number of safety events implemented.
- Component Emissions increased by 1,711 Mscf from 32,177 Mscf in 2019 to 33,888 Mscf in 2020.
- Odorizer emissions remained relatively constant with 2,941 Mscf in 2019 and 2,888 Mscf in 2020.

Table 10: Transmission Pipelines Natural Gas Emissions

Source	2015 Baseline		2019		2020		2019 - 2020 YOY Change	
	Mscf	% Total	Mscf	% Total	Mscf	% Total	Mscf	% Change
Pipeline Leaks	5,238	1%	5,068	2%	5,047	2%	(21)	(0%)
All Damages	81,793	15%	1,420	0%	13,714	5%	12,294	866%
Blowdowns	455,055	83%	252,715	86%	205,220	79%	(47,495)	(19%)
Component Emissions	4,592	1%	32,177	11%	33,888	13%	1,711	5%
Odorizers	2,570	0%	2,941	1%	2,888	1%	(53)	(2%)
Total	549,248	100%	294,321	100%	260,757	100%	(33,564)	(11%)

Transmission M&R Stations

PG&E, SoCalGas, SDG&E, SWG, and CVGS reported total Transmission M&R Stations emissions of 760,124 Mscf in 2020. This system category is largely population-based, except for the blowdowns, which are activity-based.²⁴

- Station Leak & Emissions decreased 29,810 Mscf from 721,622 Mscf in 2019 to 691,812 Mscf in 2020. This reduction is due to the change in reporting structure, as issued in the March 31, 2021, directions, that respondents may record farm taps in Distribution M&R Stations instead of Transmission M&R Stations.
- In 2020, Blowdowns remained relatively constant from 68,586 Mscf in 2019 to 68,312 Mscf in 2020.
- There were no reportable Component Emissions in 2019 or 2020 because the M&R Station EF already takes this source of emissions into account. This source is an artifact of inadvertently including component emissions that were reported for informational purposes in 2015. The 21 Mscf included in 2015 will be omitted at the same time that the 2015 Baseline adjustments are made.

Source	2015 Baseline		2019		2020		2019 - 2020 YOY Change	
	Mscf	% Total	Mscf	% Total	Mscf	% Total	Mscf	% Change
Station Leaks & Emissions	941,622	93%	721,622	91%	691,812	91%	(29,810)	(4%)
Blowdowns	65,583	7%	68,586	9%	68,312	9%	(274)	(0%)
Component Emissions	21	0%	N/A	N/A	N/A	N/A	N/A	N/A
Total	1,007,226	100%	790,208	100%	760,124	100%	(30,084)	(4%)

Transmission Compressor Stations

PG&E, SoCalGas, and SDG&E reported 2020 total Transmission Compressor Station emissions of 142,926 Mscf, which is a 923 Mscf decrease from 2019 emissions of 143,849 Mscf.

- Compressor Emissions decreased 6,096 Mscf or 11% YOY from 54,156 Mscf in 2019 to 48,060 Mscf in 2020. The decrease in emissions is due to variances in pressurized operating hours and compressor-specific emission factor.
- In 2020, Blowdowns increased 723 Mscf from 55,233 Mscf in 2019 to 55,956 Mscf in 2020.
- Component Emissions increased by 528 Mscf from 23,661 Mscf in 2019 to 24,189 Mscf in 2020.

²⁴ Population-based emissions in this category are calculated based on the number of M&R stations multiplied by an EF to obtain the emission estimate.

- Compressor and Component Leaks showed the largest emission increase in the Transmission Compressor Stations system category with an increase of 3,635 Mscf, from 10,616 Mscf in 2019 to 14,251 Mscf in 2020. Compressor and Component Leaks are further described in the 2021 Joint Report section, “Impacts of CARB’s Oil and Gas Methane Regulation (COGR).”
- Lastly, Storage Tank Leaks and Emissions increased by 287 Mscf, from 183 Mscf reported in 2019 to 470 Mscf in 2020.

Table 12: Transmission Compressor Stations Natural Gas Emissions								
Source	2015 Baseline		2019		2020		2019 - 2020 YOY Change	
	Mscf	% Total	Mscf	% Total	Mscf	% Total	Mscf	% Change
Compressor Emissions	106,257	65%	54,156	38%	48,060	34%	(6,096)	(11%)
Blowdowns	31,088	19%	55,233	38%	55,956	39%	723	1%
Component Emissions	7,186	4%	23,661	16%	24,189	17%	528	2%
Compressor and Component Leaks	18,153	11%	10,616	7%	14,251	10%	3,635	34%
Storage Tank Leaks & Emissions	3	0.0%	183	0.1%	470	0.3%	287	157%
Total	162,687	100%	143,849	100%	142,926	100%	(923)	(1%)

Distribution Mains and Services (DM&S)

PG&E, SoCalGas, SDG&E, SWG, WCGC, and Alpine Natural Gas reported total DM&S Emissions of 1,178,316 Mscf in 2020, which is a decrease of 64,286 Mscf from 1,242,602 Mscf in 2019.

- The emissions from Pipeline Leaks showed a decrease of 56,325 Mscf from 1,110,270 Mscf in 2019 to 1,053,945 Mscf in 2020. This category is the single largest category in the whole inventory and is further described in the section below, “Detailed Description of DM&S Leaks and Emissions.”
- All Damages decreased by 6,585 Mscf from 130,463 Mscf in 2019 to 123,878 Mscf in 2020.
- In 2020, Blowdowns showed a decrease of 1,377 Mscf from 1,896 Mscf reported in 2019 to 492 Mscf reported in 2020.
- There were 3,281 Mscf of Component Emissions reported in 2015, while none have been reported since.²⁵
- Lastly, Component Leaks showed an increase of 1 Mscf in 2020 relative to 2019.

²⁵ The 2015 balance of DM&S Component Emissions is an artifact of inadvertently including Component emissions provided for informational purposes and represents duplicating emissions either included in Distribution M&R Station EFs, or Customer Meter EFs. The 2015 balance will be evaluated for adjustment at the same time staff make the 2015 Baseline adjustments.

Table 13: Distribution Mains and Services Natural Gas Emissions								
Source	2015 Baseline		2019		2020		2019 - 2020 YOY Change	
	Mscf	% Total	Mscf	% Total	Mscf	% Total	Mscf	% Change
Pipeline Leaks	1,458,399	86%	1,110,270	89%	1,053,945	89%	(56,325)	(5%)
All Damages	236,145	14%	130,463	10%	123,878	11%	(6,585)	(5%)
Blowdowns	5,046	0.3%	1,869	0.2%	492	0%	(1,377)	(74%)
Component Emissions	3,281	0.2%	0	0%	0	0%	0	N/A
Component Leaks	N/A	N/A	0	0%	1	0%	1	N/A
Total	1,702,871	100%	1,242,602	100%	1,178,316	100%	(64,286)	(5%)

Detailed Description of DM&S Leaks and Emissions

The data provided by gas companies include leak discovery date, repair date, leak grade, pipeline classification as either main or service, pipeline material, method of discovery, and emissions calculation. Respondents also provided other parameters for informational purposes that were not used in any calculations, such as zip code location of leak, pipe size, pressure, and scheduled date of repair.

Table 14 shows the count of each leak grades 1 – 3, Un-surveyed leaks, and Above Ground (AG) Non-Hazardous leaks. The number of Un-surveyed (i.e., Unknown) leaks are estimated based on respondent’s leak rate, and as such, Staff does not proportionately allocate the un-surveyed leaks by the proportion of graded leaks found in respondent’s service territory.

Grade 3 leaks make up most of the DM&S leaks with 59% of the inventory. A significant amount of the grade 3 leaks carryover from previous years. In addition, PG&E uses an approved protocol where it prioritizes the repair of its “Super Emitters” to maximize the emissions reduction and as a result more grade 3 leaks are carried over to subsequent years. While the estimated un-surveyed leaks cannot be graded, these leaks make-up 32% of the leak inventory by count.

Leak Grade	Carried Over from 2019	Discovered in 2020	Repaired in 2020	Estimated Un-surveyed	Total	% of Total
Grade 1	70	8,985	(8,927)	N/A	128	0.3%
Grade 2	1,964	6,527	(5,187)	N/A	3,304	8%
Grade 3	17,567	12,543	(6,802)	N/A	23,308	59%
Un-surveyed - No grade	N/A	N/A	N/A	12,758	12,758	32%
Above Ground - Hazardous	0	0	0	0	0	0%
Above Ground - Non-Hazardous	0	0	0	0	0	0%
Total	19,601	28,055	(20,916)	12,758	39,498	100%

For further analysis on the repairing of the leaks, Table 15 shows the average days to repair per gas company and per grade, along with a weighted average for 2020.

Entity	Average Repair Days		
	Grade 1	Grade 2	Grade 3
Pacific Gas & Electric	5	115	820
Southern California Gas	4	237	825
San Diego Gas & Electric	4	23	43
Southwest Gas	1	6	13
2020 - Weighted Average	5	154	818

Grade 1 leaks are repaired quickly, taking a weighted average of five days to fix. Grade 2 leaks show more variability across the four gas companies with a range from six days to fix to 237 days to fix, with a weighted average of 154 days to repair. Finally grade 3 leaks show the most variability with a range from 13 to 825 days, and a weighted average of 818 days to repair.

²⁶ PG&E calculates its Average Repair Days based on the original discovery date, where leaks initial grade may not require immediate repair such as a grade 3 leak, when it gets subsequently regraded to a higher grade the repair prioritization changes per the requirements for the new grade. However, the average number of days to repair does not account for the leak regrade date. Therefore, it does not take many regraded old grade 3 leaks to skew the overall average time to repair.

Distribution M&R Stations

PG&E, SoCalGas, SDG&E, SWG, and Alpine Natural Gas reported 2020 total emissions in this category of 1,481,505 Mscf, which increased by 96,121 Mscf or 7% from the 972,583 Mscf reported in 2019 (see Table 16).

- Station Leaks & Emissions, Population-Based increased by 96,106 Mscf from 1,384,964 Mscf in 2019 to 1,481,070 Mscf in 2020. However, PG&E, SoCalGas, and SDG&E also submitted DM&R Station Leaks & Emissions using leaker-based methodologies, shown in Appendix A.
- There were no Blowdowns emission reported in 2020, which is a 50 Mscf decrease from 2019.
- Lastly, All Damages increased 65 Mscf from 370 Mscf in 2019 to 435 Mscf in 2020.

Source	2015 Baseline		2019		2020		2019 - 2020 YOY Change	
	Mscf	% Total	Mscf	% Total	Mscf	% Total	Mscf	% Change
	Station Leaks & Emissions, Population-Based	1,347,773	100%	1,384,964	100%	1,481,070	100%	96,106
Blowdowns	295	0%	50	0%	0	0%	(50)	(100%)
All Damages	N/A	N/A	370	0%	435	0%	65	18%
Total	1,348,068	100%	1,385,384	100%	1,481,505	100%	96,121	7%

Customer Meters

PG&E, SoCalGas, SDG&E, SWG, WGGS, and Alpine Natural Gas reported Customer Meter emissions totaling 1,704,230 Mscf which increased by 11,513 Mscf or 1% from 1,692,717 Mscf in 2019.

- Meter Leaks, Population-Based decreased by 639,284 Mscf from 1,670,536 Mscf in 2019 to 1,031,252 Mscf in 2020. However, PG&E also estimated Customer Meter emissions using a leaker-based reporting their customer meter emissions in the leaker-based category, which is shown in Appendix A.
- The All Damages category was not part of the 2015 reporting but was added in 2019. This category increased 584 Mscf from 21,125 Mscf in 2019 to 21,709 Mscf in 2020.
- Vented Emissions decreased by 172 Mscf or 16% YOY from 1,056 Mscf in 2019 to 884 Mscf in 2020. These blowdown emissions are a function of O&M activity levels and vary YOY due to a variety of repair work and maintenance performed on Customer Meters.

Table 17: Customer Meters Natural Gas Emissions								
Source	2015 Baseline		2019		2020		2019 - 2020 YOY Change	
	Mscf	% Total	Mscf	% Total	Mscf	% Total	Mscf	% Change
Meter Leaks, Population-Based	1,635,911	100%	1,670,536	99%	1,681,637	99%	11,101	1%
All Damages	N/A	N/A	21,125	1%	21,709	1%	584	3%
Vented Emissions	2,363	0.1%	1,056	0.1%	884	0.1%	(172)	(16%)
Total	1,638,274	100%	1,692,717	100%	1,704,230	100%	11,513	1%

Underground Storage

PG&E, SoCalGas, CVGS, GRGS, LGS, and WGGG reported Underground Storage systems emissions for 2020. As seen in Table 18 below, Underground Storage emissions decreased 15,248 Mscf from 161,026 Mscf in 2019 to 145,778 Mscf in 2020.

- The Storage Leaks and Emissions increased 509 Mscf from 2,160 Mscf in 2019 to 2,669 Mscf in 2020. This emission source is further described in the 2021 Joint Report section, “Impacts of CARB’s Oil and Gas Methane Regulation.”
- Compressor Emissions decreased by 2,811 Mscf from 27,432 Mscf in 2019 to 24,621 Mscf in 2020.
- Blowdown emissions decreased by 6,021 Mscf from 35,420 Mscf in 2019 to 29,399 Mscf in 2020.
- Component Emissions remained relatively constant with an increase of 1,738 Mscf or 2% from 78,956 Mscf in 2019 to 80,694 Mscf in 2020.
- Compressor and Component Leaks decreased by 8,664 Mscf from 17,046 Mscf in 2019 to 8,382 Mscf in 2020. The component leaks subsection is further described in the 2021 Joint Report section, “Impacts of CARB’s Oil and Gas Methane Regulation (COGR).”
- In the dehydrator source category, PG&E is the only source of emissions, which remained relatively constant with an increase of 1 Mscf from 12 Mscf in 2019 to 13 Mscf in 2020. All other dehydrator facilities use either a vapor recovery unit to reinject gas into the pipeline and/or thermally oxidize the glycol/methane mixture after dehydration and therefore have no reported emissions.

Table 18: Underground Storage Natural Gas Emissions								
Source	2015 Baseline		2019		2020		2019 - 2020 YOY Change	
	Mscf	% Total	Mscf	% Total	Mscf	% Total	Mscf	% Change
Storage Leaks & Emissions	15,016	8%	2,160	1.3%	2,669	1.8%	509	24%
Compressor Emissions	96,313	50%	27,432	17%	24,621	17%	(2,811)	(10%)
Blowdowns	46,358	24%	35,420	22%	29,399	20%	(6,021)	(17%)
Component Emissions	14,947	8%	78,956	49%	80,694	55%	1,738	2%
Compressor and Component Leaks	N/A	N/A	17,046	11%	8,382	6%	(8,664)	(51%)
Dehydrator Vent Emissions	20,163	10%	12	0%	13	0%	1	8%
Total	192,797	100%	161,026	100%	145,778	100%	(15,248)	(9%)

Unusual Large Leaks

There were no unusual large leaks reported in 2020. The 2019 Winter Workshop included a review of the definition for categorizing this type of emission, and it was determined that each discrete event depends on situational factors that should be reviewed and evaluated for inclusion in Unusual Large Leaks.

Lessons Learned and Conclusion

Lessons Learned

In 2021, Staff worked with gas companies to refine the annual data and understand YOY fluctuations, and the data collection and review process continued as in previous years. Staff also continued to work with gas companies to evaluate potential changes to emissions estimation methodologies prior to submission of their next Compliance Plans and future Joint Reports. As in prior years, there were lessons learned from this year's submittal and review process, some of which include:

- Staff continue to find unanticipated improvements in the reporting templates and in the data reported once the data come in. This year, Staff sent reporting template revisions in April and May, and respondents revised submitted data in July and August to correct inadvertent errors. In the future, Staff will aim to finalize all template revisions by the issue date of March 31 to avoid sending multiple reporting template updates.
- Staff continue to see different interpretations of reporting requirements. Staff will aim to clarify what is needed both within the reporting templates and in the responses to the accompanying survey questionnaire. If gas companies include an explanation of significant YOY changes and associated causes within their original submittal, this would lessen the need for Staff follow-up questions to understand the previous year's emissions.
- Staff is considering proposed 2015 Baseline adjustments. The importance of developing, approving, and communicating the process for Baseline adjustments has become more critical as gas companies plan to submit their Compliance Plans in 2022. Gas companies will need to be able to assess the relative benefit of mitigation projects implemented through these plans to ensure a smooth process for meeting emissions reduction goals in 2025 and 2030. Adjustments to the 2015 Baseline emissions were discussed during the 2021 Winter Workshop continued to be discussed by CPUC, CARB, and gas companies throughout summer and fall of 2021. Staff will continue to work with the gas companies to discuss and develop a timeline for incorporating potential adjustments to the 2015 Baseline emissions that include known discrepancies, changes in methodology, new information and updated EFs after this 2021 Joint Report is published.

Conclusion

As described in this seventh Joint Report compiled by CPUC and CARB, Staff have continued to work together with gas companies to provide for the public the total estimated natural gas emissions associated with fugitive leaks and vented emissions from the natural gas transmission and distribution system in California and the system-wide natural gas leak rate while maintaining safety as the highest priority, as ordered by the CPUC decision approving the Natural Gas Leak Abatement Program, consistent with Senate Bill 1371 (D.17-06-015).

Changes in the 2020 estimated natural gas emissions are a result of application of best practices, field verification efforts, implementation of a new leak detection threshold in CARB's Oil and Gas Methane Regulation, and changes in the reporting templates. Gas companies also began application of new methodologies for estimating Distribution M&R Station and Customer Meter emissions (see Appendix A), which will be considered for full implementation in the future.

Finally, we anticipate that the 2022 Winter Workshop will be an appropriate venue for further collaboration between CPUC, CARB, and gas companies on the following topics:

- Providing a CPUC and CARB presentation on adjustments to the 2015 Baseline emissions, as was done during the 2021 Winter Workshop.
- Updating the Distribution M&R Stations template to require labeling of farm taps and reporting of their input pressures.
- Requesting respondents to round the final reporting of emissions in Appendix 8 of the reporting template to the nearest unit of 1 Mscf.

Appendices

Appendix A: Leaker-Based Emission Estimates

Introduction

As described in the Executive Summary, leaker-based natural gas emissions estimates are calculated by using measured leaks from surveys to estimate emissions. This section first describes leaker-based natural gas emission estimates for Customer Meters, (submitted by PG&E); then describes leaker-based natural gas emission estimates for Distribution M&R Stations (submitted by PG&E, SoCalGas, and SDG&E); and finally summarizes changes to the total natural gas emissions inventory using leaker-based emissions.

The natural gas emissions estimates described in this appendix are the result of multi-year studies completed by PG&E, SoCalGas, and SDG&E to develop leaker-based emission methodologies for these appendices. These utilities have reported progress on these studies at the Winter Workshops over the last few years.

Customer Meters

With the issuance of the March 31, 2021, templates, Staff provided a worksheet for “Meter Leak, Leak Count” in Customer Meters so that gas companies could report bubble-size indications per leak and consequent bubble size leaker-based natural gas emission factors.

After the June 15, 2021, reporting, Staff noted PG&E submitted leaker-based natural gas emissions data, while SoCalGas, SDG&E, SWG, WCGC, and Alpine Natural Gas submitted population-based natural gas emissions data. The submittal of leaker-based data by PG&E was a significant undertaking as reflected by their “Identified MSA Leaks” worksheet containing more than 250,000 rows, and an additional worksheet with 20 tables to perform the analysis to determine the final total natural gas emissions.

The total 2020 estimate for PG&E’s Customer Meter natural gas emissions calculated using the leaker-based method was 245,907 Mscf. This was about one third of the total 2020 natural gas emissions calculated using the population-based method (650,385 Mscf).

Table A1 shows the Customer Meter natural gas emissions by source classification and the total Customer Meter natural gas emissions for 2019 and 2020 across all gas companies. Table A1 sums the following data:

- For 2019, the table includes population-based emission estimates submitted by PG&E, SoCalGas, SDG&E, SWG, WCGC, and Alpine Natural Gas.
- For 2020, the table includes leaker-based emission estimates submitted by PG&E and population-based emission estimates submitted by SoCalGas, SDG&E, SWG, WCGC, and Alpine Natural Gas.

Staff would like to acknowledge the multi-year effort made by PG&E to develop the leaker-based reporting in Customer Meters and look forward to further discussion with gas companies about how to incorporate the results in the main tables of future Joint Reports.

Table A1: Customer Meters Natural Gas Emissions Using Leaker-Based Data, Where Available				
Source	2019		2020	
	Mscf	% Total	Mscf	% Total
Meter Leaks, Population-Based	1,670,536	99%	1,031,252	79%
Meter Leaks, Leaker-Based	N/A	N/A	245,907	19%
All Damages	21,125	1%	21,709	2%
Vented Emissions	1,056	0.1%	884	0.1%
Total	1,692,717	100%	1,299,752	100%

Distribution M&R Stations

For Distribution M&R Stations, Staff issued an update to the template on April 15, 2021, to inform gas companies that they could report leaker-based methane emission factors from the table, “Table W-7 of Subpart W of Part 98 –Default Methane Emission Factors for Methane Distribution.” These methane emission factors were converted to natural gas emission factors using the 0.934 methane conversion factor. Also, Staff informed respondents that if they did not have leaker-based information, they should still use the population-based approach with corresponding EFs.

After the June 15, 2021, reporting, Staff noted that leaker-based reporting was submitted by PG&E for 2020, while SoCalGas and SDG&E submitted leaker-based reporting for both 2019 and 2020. Finally, population-based reporting was submitted by SWG.

PG&E, SoCalGas, and SDG&E’s leaker-based Distribution M&R Station natural gas emission estimates for 2019 and 2020 are summarized as follows:

- PG&E:
 - For 2020, PG&E reported a total of 9,440 Mscf using their leaker-based EFs compared with 883,459 Mscf in 2020 using their population-based EFs. This is a difference of 874,019 Mscf.
- SoCalGas:
 - For 2019, SoCalGas reported that their emission values decreased by 337,431 Mscf from 345,554 Mscf using population-based method to 8,123 Mscf using the leaker-based method. The total of 8,123 Mscf is the sum of their reported Component Emissions subcategory with 315 Mscf and the Component Leaks subcategory with 7,808 Mscf.

- For 2020, SoCalGas reported a total of 9,192 Mscf using leaker-based EFs (the sum of 295 Mscf for component emissions and 8,897 for component leaks) compared with 346,494 Mscf using population-based EFs. This is a difference of 337,302 Mscf.
- The YOY increase in emissions from 2019 to 2020 was 1,069 Mscf. This used leaker-based estimates for both years.
- **SDG&E:**
 - For 2019, SDG&E reported that their emissions decreased by 75,370 Mscf from 75,675 Mscf using the population-based method to 305 Mscf using the leaker-based method. The figure of 305 Mscf was attributed to their Component Leaks subcategory.
 - For 2020, SDG&E reported a total of 269 Mscf using their leaker-based EFs compared with 75,599 Mscf in 2020 using their population-based EFs. This is a difference of 75,330 Mscf.
 - The YOY increase in emissions from 2019 to 2020 was 36 Mscf. This used leaker-based estimates for both years.

Table A2 incorporates leaker-based emission estimates from PG&E, SoCalGas, and SDG&E to show total Distribution M&R Station emissions for 2019 and 2020. Table A2 sums the following data:

- For 2019, the table includes population-based estimates from PG&E and SWG and leaker-based estimates from SoCalGas and SDG&E.
- For 2020, the table includes population-based estimates from SWG and leaker-based estimates for PG&E, SoCalGas, and SDG&E.

Again, Staff would like to acknowledge the multi-year effort made by PG&E, SoCalGas, and SDG&E to develop the leaker-based reporting for Distribution M&R Stations, and look forward to further discussion with gas companies about how to incorporate the results in the main tables of future Joint Reports.

Table A2: Distribution M&R Stations Natural Gas Emissions Using Leaker-Based Data, Where Available				
Source	2019		2020	
	Mscf	% Total	Mscf	% Total
Station Leaks & Emissions, Population-Based	963,735	99%	175,518	90%
Station Leaks & Emissions, Leaker-Based	8,428	1%	18,901	10%
Blowdowns	50	0.01%	0	0%
All Damages	370	0.04%	435	0.2%
Total	972,583	100%	194,854	100%

Total Natural Gas Emissions (Appendix 8 of the Reporting Template)

Finally, Table A3 provides total 2019 and 2020 emission estimates by gas company incorporating leaker-based emission data where available. Table A3 shows the following:

- For SoCalGas and SDG&E, Table A3 shows emission reductions resulting in part from the transition to a leaker-based approach for Distribution M&R Stations. Note, SoCalGas and SDG&E submitted leaker-based data for Distribution M&R Stations for both 2019 and 2020 to provide a like-for-like YOY comparison from 2019 to 2020.
- For PG&E, Table A3 shows a YOY reduction in 2020 emissions largely resulting from the transition to leaker-based approaches for Distribution M&R Stations and Customer Meters, in comparison to the population-based data shown for 2019.
- Since the remaining seven gas companies continued to submit population-based estimates for DM&R Stations and Customer Meters for 2019 and 2020, their emissions shown in Table A3 are the same as those provided in main tables of this Joint Report.

Table A3: Total Natural Gas Emissions Using Leaker-Based Data, Where Available				
Entity	2019		2020	
	Mscf	% Total	Mscf	% Total
Pacific Gas & Electric	3,024,866	57%	1,767,382	44%
Southern California Gas	1,828,342	35%	1,784,618	45%
San Diego Gas & Electric	178,090	3%	170,341	4%
Southwest Gas	220,891	4%	222,328	6%
Wild Goose Storage	19,771	0.37%	19,676	0.49%
Gill Ranch Storage	19,008	0.36%	14,401	0.36%
Lodi Gas Storage	4,071	0.08%	2,438	0.06%
Central Valley Gas Storage	1798	0.03%	852	0.02%
West Coast Gas Company	200	0.00%	224	0.01%
Alpine Natural Gas	269	0.01%	247	0.01%
Total	5,297,306	100%	3,982,507	100%

Appendix B: Definitions

For the purposes of SB 1371, the definitions of “leak” and “gas -loss” and the formula for calculating a “system-wide gas leak rate” were defined in a different manner than elsewhere. A “leak” was defined as any breach, whether intentional or unintentional, whether hazardous or non-hazardous, of the pressure boundary of the gas system that allows natural gas to leak into the atmosphere. Any vented or fugitive emission to the atmosphere is considered a “leak”. Examples of leaking components include defective gaskets, seals, valve packing, relief valves, pumps, compressors, etc. Gas blowdowns during operations, maintenance, and testing (including hydro-testing) were also included as leaks. Consequently, this leak definition is broader than the Pipeline Hazardous Material and Safety Administration’s (PHMSA) definition.

The gas respondents are required by Federal Law, 49 CFR 192, to survey their systems for leaks, which could be hazardous to public safety or property. To accomplish this, the gas companies developed graded leak programs to detect, prioritize and repair the safety related types of leaks. The same definitions are used within this report and are as follows:

- Graded Leaks – hazardous leaks or, which could potentially become hazardous as described below:²⁷
 - A "grade 1 leak" is a leak that represents an existing or probable hazard to persons or property and requiring prompt action, immediate repair, or continuous action until the conditions are no longer hazardous.
 - A "grade 2 leak" is recognized as being non-hazardous at the time of detection but justifies scheduled repair based on the potential for creating a future hazard.
 - A "grade 3 leak" is a leak that is not hazardous at the time of detection and can reasonably be expected to remain not hazardous.
- Vented Emissions are releases of gas to the atmosphere, which occur during operations or maintenance, for a safety reason. Some examples are:
 - Purging (i.e., “blowdown”) gas prior to hydro-testing a line.
 - Gas releases designed into the equipment function, such as gas emitting from relief valve vents or pneumatic equipment.
 - Gas releases caused by operations, maintenance, testing, training, etc.
 - Ungraded Leaks are the remaining leaks, which are not hazardous to persons and/or property.

For further information please see CPUC GO 112-F.

Lastly, in 2014 the system-wide gas leak rate was calculated as a percent of total input for the 12 months ending June 30 of the reporting year. However, Staff determined that there were problems with this calculation and opted not to report a leak rate using this formula. The formula for calculating a system-wide gas leak was written as follows:

²⁷ Refer to GO 112-F for more information on grade 1, grade 2, and grade 3 leaks.

Pipeline Hazardous Material and Safety Administration (PHMSA) Modified Equation for Lost and Unaccounted for (LAUF) Gas:

[(Purchased gas + produced gas + transported gas entering the gas system) minus (customer use + company use + appropriate adjustments + gas injected into storage + transported gas leaving the gas system)] divided by (Purchased gas + produced gas + transported gas entering the gas system) = System Wide Gas Leak Rate.

Note: transported gas includes gas purchased by customers and transported in common carrier pipelines.

In section 5 of the 2015 Joint Report, “Baseline System-Wide Emissions Rate,” Staff determined the value for 2015 to be 0.32% by using the total emissions from all source categories (6,601.2 MMscf) divided by the Total Annual Volume of Gas Transported (2,056,950 MMscf). The five sources for Total Annual Volume of Gas Transported include:

- Gas Injected into Storage
- Storage – Gas Used by the Gas Department
- Gas Transported to Customers in the State
- Gas Transported to Customers out of State
- Distribution – Gas Used by the Gas Department

Appendix C: Article 3, Section 975 (c) and (e)(6)

Article 3. Section 975

(c) As soon as practicable, the commission shall require gas corporations to file a report that includes, but is not limited to, all the following:

- (1) A summary of utility leak management practices.
- (2) A list of new natural gas leaks in 2013 by grade.
- (3) A list of open leaks that are being monitored or are scheduled to be repaired.
- (4) A best estimate of gas loss due to leaks.

(e) The rules and procedures adopted pursuant to subdivision (d) shall accomplish all the following:

(6) to the extent feasible, require the owner of each commission-regulated gas pipeline facility that is an intrastate transmission or distribution line to calculate and report to the commission and the State Air Resources Board a Baseline system-wide leak rate, to periodically update that system-wide leak rate calculation, and to annually report measures that will be taken in the following year to reduce the system-wide leak rate to achieve the goals of the bill.

Appendix D: Conversion of Natural Gas to Carbon Dioxide Equivalents

The conversion of natural gas volume to carbon dioxide equivalent mass requires the use of a GWP value. CARB used the GWP value of 25 (100-year value) from the IPCC, AR4, for previous GHG emissions inventory. The following calculations show the conversion of the total emissions from this report. The conversion was done in two steps. In the first step, the calculation shows the volumetric natural gas that contains exactly one metric ton of methane.

$$1 \text{ MT CH}_4 * \frac{2,204.62 \text{ lbs CH}_4}{1 \text{ MT CH}_4} * \frac{1 \text{ lb mole}}{16.04246 \text{ lb CH}_4} * \frac{379.48 \text{ scf of CH}_4 \text{ gas}}{1 \text{ lb mole}}$$

$$* \frac{1.0 \text{ scf of natural gas}}{0.934 \text{ scf of CH}_4 \text{ gas}} * \frac{1 \text{ Mscf}}{1,000 \text{ scf}} = 55.835 \text{ Mscf of natural gas}$$

Using this volumetric unit, the 2020 total emissions, 5,673,636 Mscf, is equivalent to about 2.54 MMTCO_{2e}, as shown below:

$$5,673,636 \text{ Mscf natural gas} * \frac{1 \text{ MT CH}_4}{55.835 \text{ Mscf of natural gas}} * \frac{25 \text{ CO}_2e}{1 \text{ CH}_4} = 2,540,358 \text{ MT CO}_2e$$

CARB has also used the GWP value of 72 (AR4, 20-year) in the Short-Lived Climate Pollutant Plan and Oil and Gas Regulation. Based on the higher GWP, the 2020 total emissions, 5,673,636 Mscf is about 7.32 MMTCO_{2e}, as follows:

$$5,673,636 \text{ Mscf natural gas} * \frac{1 \text{ MT CH}_4}{55.835 \text{ Mscf of natural gas}} * \frac{72 \text{ CO}_2e}{1 \text{ CH}_4} = 7,316,232 \text{ MT CO}_2e$$

The use of 1.0 scf of natural gas per 0.934 scf of CH₄ gas accounts for composition of natural gas being not 100% methane. The American Gas Association published a value of 93.4% to be used as a default methane

concentration that is comparable to what respondents reported.²⁸ The standard cubic foot “scf” for measuring gas is based on 60 degrees Fahrenheit at atmosphere pressure.

In addition, respondents reported trace amounts of concentration for ethane, inert gases, and other elements and compounds. There was not an entry for carbon dioxide explicitly, and so it cannot be assumed that all the inert gas was carbon dioxide. A calculation was performed that showed CO2 emissions from the inert gases would be less than 0.1% of the total and is excluded in this report.

²⁸AGA, GHG Guidelines, pg. 39, April 18, 2008.

Appendix E: PG&E, Effect of 2020 Changes on Total Reported Emissions

The table below was submitted by PG&E on pages 10 and 11 as part of their SB 1371 Supplemental Questionnaire. Per PG&E's request to include the table in the appendices of the Joint Report, it is included here. Note that it shows the leaker-based emission estimates for Distribution M&R Stations and Customer Meters included in Appendix A.

Table 2. Effect of 2020 Changes on Total Reported Emissions

2020 Reporting Change	Change in Emissions Compared to Reporting Year 2019 (Mscf)	Percent Change in Emissions Compared to Reporting Year 2019
Advances in Abatement Efforts:	-43,879	
Transmission Pipeline Blowdowns	9,101	8%
Distribution Main & Service Pipelines, Pipeline Leaks	-46,202	-8%
Distribution All Damages Emissions	-7,330	-18%
Customer MSA Damages	552	14%
Change in Annual Activity:	24,405	
Transmission Pipeline Damages	2,602	183%
Transmission M&R Station Blowdowns	19,674	29%
Transmission Compressor Station and Underground Storage Facility Blowdowns (combined)	-2193	-4%
Transmission Compressor Station Storage Tank Emissions	298	100%
Distribution Blowdown Emissions	23	16%
Customer MSA Vented and Blowdown Emissions	-34	-18%
Other ¹	4,035	5%
Improvements in Reporting Practices:	-1,223,785	
Transmission Pipeline Component Vented Emissions	2,431	10%
Transmission Compressor Station and Underground Storage Facility Compressor Emissions (combined)	-29,063	-55%
Transmission Pipeline Component Leaks	-	-
Transmission M&R Station Leaks and Emissions	-25,145	-4%
Transmission Compressor Station Component Emissions	-64	-0.3%
Transmission Compressor Station and Underground Storage Facility Component Leaks (combined)	8,435	164%
Distribution Main & Service Pipelines, Pipeline Leaks	emission changes captured in advances in abatement efforts	
Distribution M&R Station Leaks and Emissions, Population-Based	-790,545	-100%
Distribution M&R Station Leaks and Emissions, Leak-Based	9,440	100%
Distribution M&R Station Blowdown Emissions	56	27%
Customer Meters Aboveground MSA Leaks, Population-Based	-645,997	-100%
Customer Meters Aboveground MSA Leaks, Leak-Based	245,907	100%
Underground Storage Facility Storage Leaks and Emissions	760	42%
Total Change:	-1,243,259	-41.1%

¹Other includes Transmission Pipeline Leaks, Distribution Main & Service Pipeline Blowdowns, Underground Storage Component, Dehydrator Vent Emissions.